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ON DISTINGUISHING STEREUM GAUSAPATUM FROM THE "S. HIRSUTUM-COMPLEX"

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ABSTRACT

A new character is proposed that can be used to help distinguish Stereum gausapatum from members of the S. hirsutum-complex, sensu Welden (S. hirsutum, S. complicatum and S. versicolor). An analysis of pseudocystidial wall thickness indicates that, on average, S. gausapatum possesses walls less than 1.5 μ m while the other species possess an average wall thickness greater than 1.5 μ m.

Welden (1971) suggested the combination of numerous well-established species of Stereum (sensu stricto) into a few "species complexes", based primarily on the existence of gross morphological continua and an apparent lack of reliable microscopic and cultural characters. Within one of these, the S. hirsutum-complex, he included S. hirsutum (Willd.:Fr.) S.F. Gray, S. complicatum (Fr.:Fr.) Fr. (= S. rameale (Schw.) Burt), S. styraciflum (Schw.:Fr.) Fr., S. subtomentosum Pouzar, S. versicolor (Sw.:Fr.) Fr., and S. gausapatum (Fr.:Fr.) Fr.

The hypothesis put forth in the present paper is simple: S. gausapatum can be distinguished reliably from the remainder of the aforementioned species and therefore should not be included in the S. hirsutum-complex. In

addition to S. gausapatum, the principal New World species of the complex were studied: S. hirsutum, S. complicatum and S. versicolor.

Interfertility studies are not useful in Stereum s.s. because members of the genus have holocoenocytic nuclear behavior and are assumed to be homothallic (Boidin, 1958a, 1958b, 1971). However, recent evidence suggests that at least some Stereum species exhibit heterokaryon formation when monosporous isolates are confronted (Boddy and Rayner, 1982; Chamuris, unpublished; Coates et al., 1981; Rayner and Turton, 1982). These mycelial interactions may reflect true sexuality, but likely indicate a type of somatic incompatibility. Either way, the practicing mycologist who wishes to identify a specimen in hand must rely upon a morphological species concept. What then are the characters that can be used to separate S. gausapatum from S. hirsutum?

Traditional morphological descriptions of species in this group carry "usually" type qualifiers. The basidiomata of S. gausapatum vary from effused, effuso-reflexed to pileate, and are "usually" radially plicate. The hymenial surface of fresh specimens "usually" bruises or bleeds red, while dried specimens show dark violet or blackish stains. In well-developed specimens the hymenial surface is somewhat folded radially, reflecting the plicate tendency. Eriksson et al. (1984) state that ". . . the colour of the hymenium . . . is buff to clay coloured in S. gausapatum, yellow to pale orange in S. hirsutum." Although this is "often" true, it is frequently difficult to demonstrate reliably, especially in older herbarium specimens. Conducting hyphae and pseudocystidia with brownish contents are "usually" evident in radial section.

Many exceptions plague the above mentioned characters. For example, specimens of S. gausapatum can be found which are not radially plicate (young) and show little evidence of bleeding or bruising. S. complicatum may bruise red, but microscopic examination of radial sections reveals that the conducting hyphae do not possess the brownish contents typical of S. gausapatum. S. versicolor is a neotropical expression of S. hirsutum, and may possess brownish conducting hyphal contents. This situation parallels that seen in S. australe, a tropical expression of S. fasciatum (S. fasciatum-complex).

It would seem that the darkness of the conducting hyphal and pseudocystidial contents is due at least in part to environmental factors, and therefore is not a dependable character in tropical areas. The presence of conducting hyphae and pseudocystidia with dark contents is, however, a fairly reliable character for separating S. gausapatum from the S. hirsutum-complex in temperate areas.

S. gausapatum "almost always" produces basidiomata on stumps or limbs of oak species. This association with Quercus species seems to be a reliable character in Europe as well as in North America. Eriksson et al. (1984) report that S. gausapatum follows the distribution of Quercus in Europe. S. complicatum and S. hirsutum may be associated with oaks (see Table 2, Chamuris 1983); however when the substrate can be identified as oak wood, the stereum most likely to be present is S. gausapatum (see Tables 1-4).

In addition to substrate, a reliable character for separating S. gausapatum from members of the S. hirsutum-complex is the degree to which the wall of the hymenial pseudocystidia becomes thickened. In Stereum, conducting hyphae (also called vascular or sanguinolentous hyphae) run radially through the context, curve downwards into the hymenium, and end as embedded or slightly protruding pseudocystidia (Fig. 1). S. hirsutum, S. complicatum and S. versicolor have thick-walled pseudocystidia (Fig. 1a) while S. gausapatum has relatively thin-walled pseudocystidia (Fig. 1b). This paper is concerned with an analysis of this character.

Although this difference in wall thickness is striking in radial sections, one can find only brief and suggestive mention of it in the literature. Pouzar (1959) apparently noticed the difference when he erected the genus Haematostereum (a rejected genus that included S. gausapatum). Jülich and Stalpers (1980) used relative pseudocystidial wall thickness as a character in their key to North Temperate sterea. The wall thickness character was mentioned neither by Welden (1971) nor by Lentz (1955, 1960), however Lentz (1955, Pl. 15D) and Rattan (1977, p. 165, Fig. A) presented line drawings of S. gausapatum depicting thin-walled pseudocystidia. Eriksson et al. (1984) mention the character, but do not call special attention to it. In addition, their excellent line

drawings of S. gausapatum (Fig. 746, p. 1418) and S. hirsutum (especially Fig. 750, p. 1424 and Fig. 751, p. 1425) clearly illustrate the wall thickness difference.

In an attempt to quantify the expressions "thick-walled" and "relatively thin-walled", as well as to determine if the thickness difference was clear and dependable, the average pseudocystidial wall thickness for each of 62 specimens was determined. The specimens were grouped initially according to aspect, gross morphology, color of conducting hyphal contents and substratum. Seventeen were grouped as S. hirsutum, 13 as S. complicatum, 6 as S. versicolor and 26 as S. gausapatum. Species concepts were developed previously both by a study of the historical literature and by examination of specimens and exsiccata determined by a variety of authorities. Specimens were chosen for their broad geographical representation of 17 countries and 19 states. All specimens are held in the Cryptogamic Herbarium at the New York Botanical Garden.

METHODS AND MATERIALS

Radial sections cut by hand with a razor blade (from several basidiomata per collection when possible) were mounted in a drop of 3% KOH. Sections were taken from several points along the radial distance of each pileus. Mounts were examined under 1500x magnification (oil immersion), and the color of conducting hyphae and pseudocystidia were noted. The mount was then squashed gently to isolate the hymenial elements sufficiently for measurement of wall thickness.

Using an eyepiece micrometer the wall thickness of each of ten randomly selected pseudocystidia from at least two sections was measured. Measurements were made to the nearest 0.5 μm when the walls were at least 1.0 μm thick. Walls less than 1.0 μm thick were judged to have a thickness between 0.5 and 1.0 μm (estimated as 0.75 μm) or between 0 and 0.5 μm (estimated as 0.25 μm).

Walls were measured at the base of the pseudocystidia (Fig. 1a and 1b). This is where they bend into the hymenium, and is the most convenient area for making

measurements. It should be pointed out that in S. gausapatum, thick-walled contextual hyphae become increasingly abundant toward the adhymenial side; and as in other sterea, become the dominant type in the cutis and tomentum.

Two pitfalls in wall measurement should be mentioned. First, care must be taken to distinguish the pseudocystidial wall from the walls of adjacent hyphae. This is of special concern when the pseudocystidia have

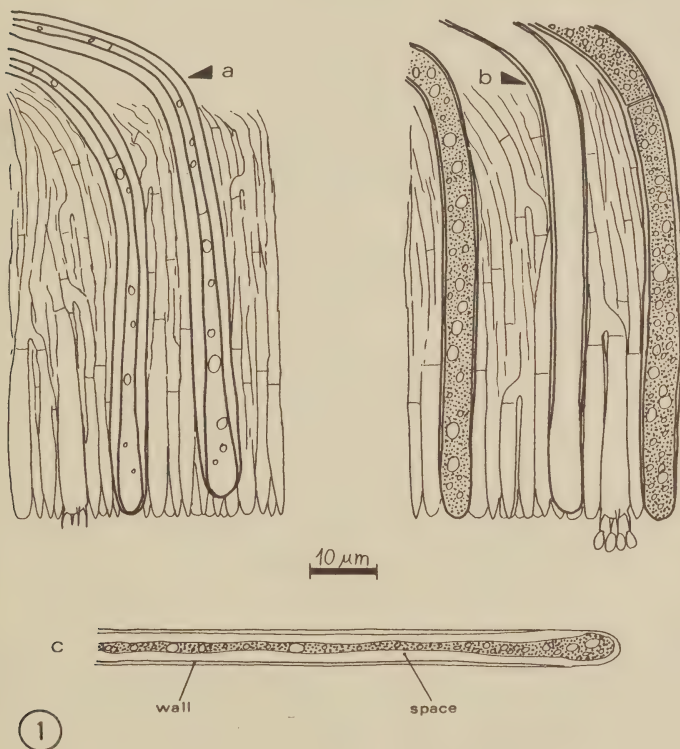


Fig. 1. Measuring pseudocystidial wall thickness. Walls are measured at the base of the hymenium in *S. hirsutum*, a; and *S. gausapatum*, b. When the contents retract, care must be taken to measure the wall, not the space, c.

lost their content, and the lumen gives the impression of a "space" in the section. The second pitfall concerns the shrinkage of the pseudocystidial contents. The surface tension of the contents creates the illusion of a surrounding membrane. The space between this boundary and the inner face of the wall should not be mistaken for the wall itself (Fig. 1c).

The wall thickness data are presented in Tables 1-4. Mean wall thicknesses were compared using the Student's t-distribution (Sokal and Rohlf, 1981).

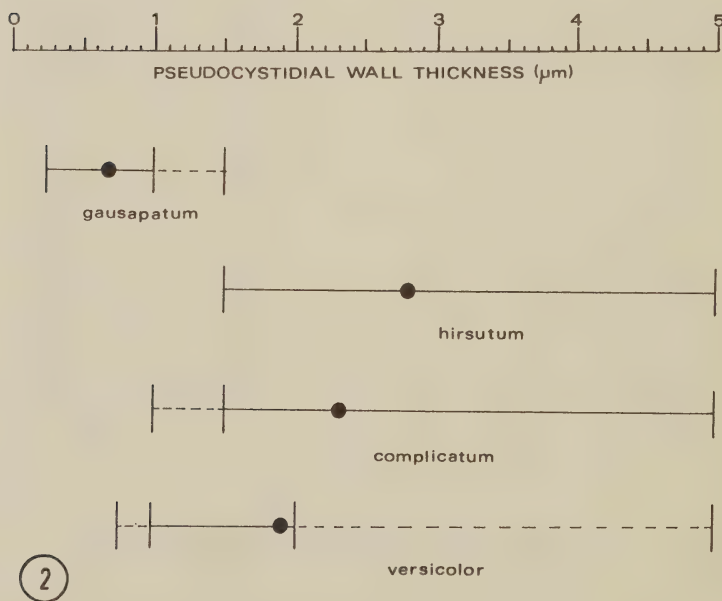


Fig. 2. Comparison of pseudocystidial wall thickness data. Dots indicate the mean wall thickness; the lines indicate the range of values. Dotted lines indicate that less than 5% of the walls fell within this range.

Table 1. Mean pseudocystidial wall thickness data (μm) $\pm$ s.d. for S. hirsutum.

SPECIMEN	LOCATION	SUBSTRATE	PSEUDOCYSTIDIA		
			WALL THICKNESS MEAN	THICKNESS RANGE	CONTENT COLOR
Buck 9943	ECUADOR	unknown	2.7 ± 0.6	2.0-4.0	PYB
Luteyn 8973	ECUADOR	dead tree	2.0 ± 0.4	1.5-3.0	PY
Bresadola, 1897	ITALY	<u>Eucalyptus</u> <u>globulus</u>	3.1 ± 0.5	1.5-4.0	PY
Anonymous	GERMANY	unknown	2.5 ± 0.3	1.5-3.0	PY-PYB
CUP-ME 157	MEXICO	<u>Pinus</u> sp.	3.3 ± 1.2	2.0-4.0	PY
CUP-ME 313	MEXICO	unknown	2.8 ± 0.4	1.5-4.0	H
Brass 17266	MALAWI	dead wood	2.9 ± 0.4	2.0-3.5	H
Merrill 6895	PHILIPPINES	unknown	3.4 ± 0.9	2.0-5.0	PY
EAAFR0 317	UGANDA	hardwood slash	4.0 ± 0.9	2.0-5.0	H
McClatchie 145	CALIFORNIA	decaying wood	3.7 ± 1.0	2.0-5.0	PYB
Morse 330	CALIFORNIA	bark	2.6 ± 0.4	2.0-3.0	H
EEK 6096	FLORIDA	unknown	4.0 ± 0.9	2.5-5.0	H
Rogerson, ix.1970	NEW YORK	unknown	1.9 ± 0.3	1.5-2.5	H
Chamuris 1192	NEW YORK	hardwood	2.4 ± 0.5	2.0-3.5	H-PY
Chamuris 1237	NEW YORK	hardwood	2.0 ± 0.2	1.5-2.0	H
Lloyd, x.1897	OREGON	unknown	2.6 ± 0.5	2.0-3.5	H-Y
Henry 5213	PENNSYLVANIA	log	2.5 ± 0.8	1.5-4.0	H-PY
		Pooled mean	2.8 ± 0.6		

Abbreviations: CUP-ME=Cornell University, Specimens from Mexico; EAAFR0=East African Agricultural and Forest Research Organization; EEK=Exploration of the Everglade Keys

Color code: H=hyaline; PY=pale yellow; PYB=pale yellow-brown.

Table 2. Mean pseudocystidial wall thickness data (μm) $\pm$ s.d. for S. complicatum.

SPECIMEN	LOCATION	SUBSTRATE	PSEUDOCYSTIDIA		
			WALL THICKNESS MEAN	RANGE	CONTENT COLOR
Prance et al.	BRAZIL	unknown	1.8 ± 0.4	1.0-2.5	YB
Weiden 2986	COSTA RICA	unknown	2.8 ± 0.6	2.0-4.0	H-PYB
Escobar 5088	EL SALVADOR	unknown	2.5 ± 0.3	2.0-3.0	H-PY
Isotype? S. rameale	ALABAMA	unknown	2.3 ± 0.5	1.5-3.0	Y
Doutt, CM 20307	GEORGIA	unknown	2.4 ± 0.3	2.0-3.0	PY
Earle, viii.1908	LOUISIANA	unknown	2.2 ± 0.6	1.5-3.0	H-PYB
Chamuris 1503	NEW YORK	<u>Quercus rubra</u>	2.4 ± 0.5	1.5-3.0	PY
Chamuris 1584	NEW YORK	hardwood	2.0 ± 0.3	1.5-2.5	H-PY
Jennings, CM 8059	PENNSYLVANIA	hardwood	1.8 ± 0.4	1.5-2.5	PY
Sumstine, CM 14270	PENNSYLVANIA	unknown	2.4 ± 0.4	1.5-3.0	PYB
Henry 4393	PENNSYLVANIA	<u>Fagus</u> sp.	3.2 ± 1.0	1.5-5.0	Y
Chamuris 1276	PENNSYLVANIA	hardwood	2.3 ± 0.3	2.0-3.0	PY
Richmond, CM 14290	VIRGINIA	unknown	2.0 ± 0.4	1.5-2.5	Y
Pooled mean			2.3 ± 0.4		

Abbreviation: CM=Carnegie Museum.

Color code: H=hyaline; PY=pale yellow; PYB=pale yellow brown; Y=yellow; YB=yellow-brown.

RESULTS

Wall thickness comparisons are illustrated graphically in Fig. 2. The mean pseudocystidial wall thickness for S. gausapatum is significantly less ($p = 0.02$) than that for S. hirsutum, S. complicatum and S. versicolor. There was no significant difference ($p = 0.02$) between S. hirsutum and S. complicatum.

In S. gausapatum, 7 of the 260 walls (3%) measured 1.5 μm , but most of the walls (97%) were between 0.25 and 1.0 μm in thickness. In S. complicatum, 1 of the 130 walls (0.8%) measured 1.0 μm . Most of the remainder fell between 1.5 and 3.0 μm , with some between 3.0 and 5.0 μm . The walls in S. hirsutum ranged from 1.5 to 5.0 μm in thickness.

S. versicolor is somewhat intermediate. Although its mean wall thickness (1.9 μm) did not differ from that of S. hirsutum and S. complicatum at $p = 0.001$, there is a difference at $p = 0.01$. S. versicolor shows 13 of the 60 walls (22%) being less than or equal to 1.0 μm in thickness, but 78% are up to 5.0 μm in thickness. These data may be explained by one or more of the following: 1) small sample size for S. versicolor ($N = 6$), 2) greater variation in wall thickness, 3) S. versicolor has walls thinner than S. hirsutum and S. complicatum (but thicker than S. gausapatum). Items 1 and 2 provide the most reasonable explanation.

Table 3. Mean pseudocystidial wall thickness data (μm) $\pm$ s.d. for S. versicolor.

SPECIMEN	LOCATION	SUBSTRATE	PSEUDOCYSTIDIA		
			WALL THICKNESS MEAN	RANGE	CONTENT COLOR
CUP-BO 57	BOLIVIA	log	2.2 $\pm$ 0.5	1.5-3.0	YB-B
CUP-BR 47	BRAZIL	log	2.3 $\pm$ 0.5	1.5-2.5	B
Welden 952	JAMAICA	frondose wood	1.0 $\pm$ 0.2	0.75-1.5	B
Shafer 3692	PUERTO RICO	unknown	1.5 $\pm$ 0.4	1.0-2.0	B
Small, EEK 7089	FLORIDA	unknown	2.7 $\pm$ 1.1	1.5-5.0	PY
Underwood 1377	FLORIDA	unknown	1.9 $\pm$ 0.4	1.0-2.5	H-PY
Pooled mean			1.9 $\pm$ 0.5		

Abbreviations: CUP-BO=Cornell University, specimens from Bolivia;
CUP-BR=Cornell University, specimens from Brazil; EEK=Exploration of the
Everglade Keys.

Color Code: B=brownish; H=hyaline; PY=pale yellow; YB=yellow brown.

Table 4. Mean pseudocystidial wall thickness data (μm) $\pm$ s.d. for S. gausapatum.

SPECIMEN	LOCATION	SUBSTRATE	PSEUDOCYSTIDIA		
			WALL THICKNESS MEAN	RANGE	CONTENT COLOR
Cain 2697	CANADA (ONT.)	<u>Quercus</u> sp.	0.6 ± 0.3	0.25-1.0	B
Teng 3528	CHINA	<u>Quercus</u> sp.	0.7 ± 0.2	0.25-1.0	B
Cooke, FBE 107	ENGLAND	unknown	0.5 ± 0.3	0.25-1.0	B
Sharp 4865	GUATEMALA	<u>Quercus</u> sp.	0.9 ± 0.1	0.75-1.0	B
Bresadola, x.1900	ITALY	<u>Quercus</u> sp.	0.75 ± 0	0.75	B
Sharp 16816	MEXICO	<u>Quercus</u> sp.	1.0 ± 0.2	0.75-1.5	B
Sharp 16817	MEXICO	<u>Quercus</u> sp.	0.4 ± 0.3	0.25-1.0	B
Romell, FEPS 28	SWEDEN	<u>Quercus</u> sp.	0.6 ± 0.3	0.25-1.0	B
Bartholomew, FC 2883	ARKANSAS	<u>Quercus</u> sp.	0.75 ± 0	0.75	B
Commons, CM 13788	DELAWARE	unknown	0.9 ± 0.5	0.25-2.0	B
Tulane 408	FLORIDA	unknown	0.9 ± 0.3	0.25-1.5	B
Doutt, CM 20307	GEORGIA	dead log	0.75 ± 0	0.75	B
Garrett KF 86	KANSAS	<u>Quercus</u> sp.	1.1 ± 0.7	0.75-1.0	B
Henry, viii.1960	LOUISIANA	unknown	0.75 ± 0	0.75	B
Ellis and Everh., FC 218	NEW JERSEY	<u>Quercus</u> sp.	0.6 ± 0.2	0.25-0.75	B
Smith 29415	NEW YORK	<u>Q. alba</u>	0.7 ± 0.3	0.25-1.0	B
Rogerson, x.1966	NEW YORK	<u>Q. alba</u>	0.25 ± 0	0.25	B
Rogerson, x.1966	NEW YORK	<u>Q. velutina</u>	0.5 ± 0.3	0.25-1.0	B
Henry, viii.1931	NEW YORK	unknown	0.6 ± 0.2	0.25-0.75	B
Rhoads, 1915	NEW YORK	<u>Quercus nigra</u>	0.7 ± 0.2	0.25-1.0	B
Brenckle, FD 522	N. DAKOTA	<u>Q. macrocarpa</u>	0.8 ± 0.1	0.75-1.0	B
Welden, Tulane 7416	OHIO	<u>Quercus</u> sp.	0.8 ± 0.3	0.25-1.5	B
Sumstine, CM 4752	OHIO	unknown	1.1 ± 0.2	0.75-1.5	B
Grover 14297	OHIO	<u>Quercus</u> sp.	0.6 ± 0.4	0.25-1.0	B
Henry 5624	PENNSYLVANIA	log	0.9 ± 0.2	0.75-1.5	B
Weir, x.1921	WASH., D.C.	<u>Q. marylandica</u>	0.9 ± 0.4	0.25-1.5	B
		Pooled mean	0.7 ± 0.2		

Table 4 continued.

Abbreviations: CM=Carnegie Museum; FBE=Fungi Britannica Exsiccati;
 FC=Fungi Columbiani; FEPS=Fungi Exsiccati Praesertim Scandinavici;
 FD=Fungi Dakatotenses; KF=Kansas Fungi.

Color code: B=brownish

DISCUSSION

The results presented in this paper suggest that the thickness of the pseudocystidial walls can be used to distinguish S. gausapatum from the other members of the S. hirsutum-complex, sensu Welden (1971). The accepted members of the complex, then, are S. hirsutum (= S. styracifluum, = S. subtomentosum), S. complicatum, and S. versicolor.

The wall thickness character can be used to confirm judgments made on the basis of field and gross morphological observations. For a S. gausapatum candidate, these include habitation of oak wood, the bleeding or bruising red of the fresh hymenial surface (or dark stains on dry hymenia), and radially plicate pilei.

In the Temperate Zone, a microscopic clue would be the presence of brownish pseudocystidial and conducting hyphal contents. Finally, after measuring 5-10 pseudocystidial walls at the base of the hymenium, an average thickness of less than 1.5 μm should solidify the decision to place the specimen in S. gausapatum.

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FOUR NEW SPECIES OF NECTRIA AND THEIR CHAETOPSINA ANAMORPHS

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SUMMARY

Four new species of Nectria Fries are described: N. chaetopsinae, N. chaetopsinae-polyblastiae, N. chaetopsinae-penicillatae, and N. chaetopsinae-catenulatae. Their anamorphs are, respectively, Chaetopsina cf. fulva Rambelli, C. polyblastia sp. nov., C. penicillata sp. nov., and C. catenulata sp. nov. The relationship of Chaetopsina Rambelli to other anamorph fungi having setiform conidiophores is discussed. It is suggested that Chaetopsina be restricted to species with setae that become yellow in 100% lactic acid and that are anamorphs of Nectria species.

Chaetopsina Rambelli anamorphs were found in close proximity to perithecia of four species of Nectria Fries collected in the American tropics and/or New Zealand. Colonies derived from single ascospores of these species of Nectria produced Chaetopsina conidiophores in pure culture that were morphologically similar to those found in nature.

The Chaetopsina teleomorphs are closely related species of Nectria. The smooth, red, superficial, perithecia are anatomically and morphologically strongly reminiscent of Nectria episphaeria (Tode : Fries) Fries and its relatives (Booth 1959), hypersaprophes with Fusarium Link : Fries and Verticillium Nees anamorphs usually occurring on stromatic ascomycetes; and of N. consors (Ellis & Everhart) Seaver, which has a Volutella Fries anamorph (Samuels 1977). The Chaetopsina teleomorphs are apparently not hypersaprobic; like N. consors, they occur on decaying herbaceous debris or wood.

The perithecial wall of the Chaetopsina teleomorphs is typical of the perithecial wall found in the Nectria episphaeria group. The wall comprises intertwined hyphae, the cells of which appear more or less elliptical in section. Cells of the wall seen in surface view are textura epidermoidea and their walls are unevenly thickened and adjacent cells are connected by pores.

Eight species of Chaetopsina have previously been described (Table 1), all of which inhabit herbaceous debris and wood and are generally found in geographical areas having a warm climate (Africa, Papua New Guinea, Taiwan, Brazil, Japan, southern U.S.A.); the collection reported by Ellis (1971) from Canada is an exception. Until now, none has been reported to have a teleomorph. The anamorph of Nectria chaetopsinae sp. nov. is morphologically similar to the type species of Chaetopsina, C. fulva Rambelli (1956), and may be that species. None of the other Chaetopsina anamorphs of Nectria could be identified with any of the previously described species of Chaetopsina and are proposed as new species.

Chaetopsina fulva, as originally described from decaying leaves in northern Italy (Rambelli 1956), has cylindrical conidia, $7.5\text{--}10.8 \times 1.0\text{--}1.5 \mu\text{m}$. Subsequent collections have been reported from decaying leaves, pine needles and soil by Barron (1968), Ellis (1971), Matsushima (1971, 1975, 1980) and Pirozynski & Hodges (1973) from the U.S.A. (South Carolina), Canada, Taiwan, Japan (Hyogo, Sendai, Tokyo) and Papua New Guinea. Conidia in these collections were described as cylindrical; conidia in most ranged from $(8\text{--})10\text{--}13 \times (1.0\text{--})1.2\text{--}1.5 \mu\text{m}$. Conidia from the two collections associated with N. chaetopsinae were oblong and measured (in vivo) $(5.0\text{--})5.6\text{--}7.2(8.5) \times 1.0\text{--}1.3(1.7) \mu\text{m}$ and are thus shorter than is reported for C. fulva; conidia formed in culture measured $(6.5\text{--})9.3\text{--}17.3(22.0) \times 2.0\text{--}2.5(3.0) \mu\text{m}$. In other morphological details the Nectria anamorph is identical to C. fulva.

Chaetopsina was originally described (Rambelli 1956) for hyphomycetes having a pigmented, setose conidiophore with a sterile apex and laterally produced, thin-walled, non-pigmented branches bearing monoblastic phialides. Conidia were unicellular and held in slime heads. The original species was C. fulva. With the eight species that have been added since 1956, and with the three that are added herewith, the circumscription of Chaetopsina has gradually been expanded and now includes species that have a thick-walled, pigmented, setose conidiophore with a sterile or fertile apex and with or without sterile, setose branches; phialides are either monoblastic or polyblastic and conidia are either unicellular or bicellular and held singly or in slimy heads or chains (Table 1).

Chaetopsina most closely resembles Chaetopsis Grev., Gonytrichum Nees & Nees, Phaeostalagmus Gams, and Acrophialophora Edwards (see illustrations in Ellis 1971, Carmichael et al. 1980). Chaetopsina and Chaetopsis have been distinguished primarily on the basis of the presence of polyblastic phialides in Chaetopsis (Rambelli & Lunghini 1976) but polyblastic phialides are also found in Chaetopsina ivoriensis Rambelli & Lunghini (Rambelli & Lunghini 1976), C. romantica Rambelli & Lunghini [Morgan-Jones 1982; = Chaetopsis romantica (Rambelli & Lunghini) DiCosmo, Berch & Kendrick, 1983], and in the Chaetopsina anamorph of Nectria chaetopsinae-polyblastiae sp. nov. In one of the specimens of C. fulva cited by Matsushima (1980) from Taiwan (PDD 44253 ex MFC 8266) some conidiophores had only monoblastic phialides while on other conidiophores monoblastic and polyblastic phialides were present. Morgan-Jones (1982) questioned whether Chaetopsina and Chaetopsis could be maintained as distinct genera but he concluded that the primary differences between the two

genera lie in the orientation and morphology of the phialide bearing branches: acutely divergent, thick-walled and robust toward the point of origin in Chaetopsis as opposed to branches that are usually oriented more or less parallel to the seta and are generally flexuous and thin-walled in Chaetopsina. To these differences, it can be added that the reddish-brown seta in the anamorphs of Nectria becomes yellow in 100% lactic acid, a reaction paralleling the reaction in the perithecial wall of species of Nectria having red perithecia and apparently known only in the Hypocreales. The conidiophores of the Taiwanese collection of C. fulva cited above were reddish-brown and exhibited the same reaction. The conidiophores of one specimen of Chaetopsis grisea (Ehrenb.) Sacc. (PDD 15026 ex IMI 13928 c), the type species of Chaetopsis, were dark brown and remained brown in 100% lactic acid.

In Phaeostalagmus phialides either arise directly from the setose conidiophore or are arranged in ill-defined verticils. However, colonies of Phaeostalagmus are grey to black (Gams & Holubová-Jechová 1976), not brown as in Chaetopsina (Rambelli & Lunghini 1976 and data published herewith), and the phialides are Phialophora- or Chloridium-like, possessing a widely flaring collarete, whereas phialides of Chaetopsina have only a narrow opening which is not flared. Phaeostalagmus is differentiated from Gonytrichum through the method of attachment of the phialide-bearing branches to the seta. In Phaeostalagmus the phialophorous branches subtend a much larger angle relative to the seta above than do those of Gonytrichum, which may be appressed to the seta. In Cryptophiale Pirozynski the fertile branches arise from a dark brown seta and are densely compacted in the form of a shield (Pirozynski 1968, Sutton & Hodges 1976). Are these differences, in themselves, sufficient for generic delimitation? The phialophorous branches of C. fulva are closely appressed to the seta while among the other Chaetopsina anamorphs of Nectria two possibilities occur; conidiophorous branches of N. chaetopsinae-polyblastiae sp. nov. lie almost parallel to the seta while the phialophorous branches of N. chaetopsinae-catenulatae sp. nov. are more widely divergent. The only known teleomorph of Gonytrichum is the sphaeriaceous ascomycete Melanopsamella inaequalis (Grove) Höhnelt; although teleomorphs are not known for Phaeostalagmus and Cryptophiale, the phialides suggest anamorphs of such sphaeriaceous ascomycetes as Lasiosphaeria Ces. & de Not. (Gams & Holubová-Jechová 1976) or Chaetosphaeria Tul. (Gams & Holubová-Jechová 1976). It is reasonable to ask whether Phaeostalagmus, Gonytrichum, and Cryptophiale are extremes within the same pattern of development that is found in Chaetopsina.

Acrophialophora is distinguished from Chaetopsina in that its conidia are dry and are borne end to end in chains; colonies are dark brown to black in reverse (Samson & Mahood 1970). Conidia of N. chaetopsinae-catenulatae sp. nov. are held in chains in nature but chains that form in culture slime down.

The examples given above indicate that the setiform conidiophore has arisen many times in the phialidic anamorph fungi; it is also a normal type of development in other ontogenetic series of anamorph fungi [e.g. Spondylocodiopsis M.B. Ellis and Circinotrichum fertile Pirozynski & Hodges in the denticulate series; Verticicladium Preuss,

Table 1. Summary of Chaetopsina species.

	CONIDIA size (μ m)	septa	PHIALIDES	color	FERTILE SETAE apex	sterile branches
<u>C. ivoriensis</u> <u>Rambelli & Lunghini</u> (1976)	3-5 x 1.2-2.5	0	globose- ampulliform, mono- polyblastic	dark brown	sterile	-
<u>C. auburnensis</u> <u>Morgan-Jones</u> (1979)	4-8 x 0.5-0.75	0	globose, monoblastic	brown	sterile	-
<u>C. romantica</u> <u>Rambelli</u> (1979)	7-11.5 x 1.5-2.5	0	cylindrical, monoblastic	'Mars brown'	sterile or fertile	-
<u>C. fulva</u> <u>Rambelli</u> (1956)	7-14 x 1.6-2	0	ampulliform- cylindrical, mono- polyblastic	brown	sterile	-
<u>C. polyblastia</u> sp. nov.	7-9 x 2.5-3	0	cylindrical, mono- polyblastic	red- brown	fertile	-
<u>C. ramifera</u> <u>Matsushima</u> (1971)	8-12 x 1-1.5	0	cylindrical, monoblastic	dark brown	sterile	+
<u>C. ludoviciana</u> Crane & <u>Schoknecht</u> (1982)	9-11 x 1.3-1.5	0-1	cylindrical, monoblastic	brown	sterile	+
<u>C. splendida</u> Sutton & <u>Hodges</u> (1976)	9.5-12 x 1.5	0	cylindrical, monoblastic	red- brown	sterile	+
<u>C. penicillata</u> sp. nov.	9.4-22.3 x 5.9-10.3	0	cylindrical, monoblastic	red- brown	sterile or fertile	-
<u>C. catenulata</u> sp. nov.	12-16 x 2.5-2.5	0-1	cylindrical, monoblastic	red- brown	fertile	-
<u>C. virtuosa</u> Rambelli & <u>Lunghini</u> (1979)	20.5-34.5 x 2.0-2.5	0-1	cylindrical, mono- polyblastic	'Yellow ochre'	sterile	-

Verticicladiella Hughes in the holoblastic-sympodially proliferating series, and Haplographium Berkeley & Broome in the holoblastic-percurrently proliferating series].

It is doubtful that all the species currently disposed in Chaetopsina are actually congeneric with C. fulva. The red-brown conidiophore that turns yellow in lactic acid is a striking feature of Chaetopsina fulva and the other Chaetopsina anamorphs of Nectria. Because of their association with similar species of Nectria, it seems reasonable to limit Chaetopsina to species having a red-brown conidiophore that turns yellow in lactic acid. It is unlikely that the conidiophores of species having dark brown to black setae fit into this series of Nectria anamorphs; for example C. auburnensis Morgan-Jones (Morgan-Jones 1979), a species that is morphologically close to C. fulva but which is described as having dark brown or black colonies and brown conidiophores and phialides, C. ludoviciana Crane & Schoknecht (Crane & Schoknecht 1982), or C. ramifera Matsushima (Matsushima 1971). Other species should also be regarded with circumspection.

In a discussion of the setose genera Cylindrotrichum and Chaetopsis, DiCosmo et al. (1983) quantified the "intuitive process" of taxonomy of anamorph fungi by giving characters numerical values on the basis of their frequency of occurrence among anamorph genera. The features given greatest weight were considered to have the greatest taxonomic utility. Conidial shape and the presence of polyphialides were accorded the greatest significance; the formation of setose conidiophores was given lesser importance. As a result of this analysis they synonymized Cylindrotrichum with the older Chaetopsis and the definition of Chaetopsis was modified to include polyphialidic, sympodially proliferating conidiogenous cells and 0-1-septate, cylindrical conidia. They described two new genera, Kylindria DiCosmo, Berch & Kendrick and Xenokylindria DiCosmo, Berch & Kendrick, for species formerly included in Cylindrotrichum. These two genera were distinguished from Chaetopsis because their conidiogenous cells are monophialidic and their conidia are oblong-elliptic. Kylindria was distinguished from Xenokylindria through the non-proliferating phialides in the former and the percurrently proliferating phialides in the latter.

Although I do not disagree with their taxonomic conclusions, the present work demonstrates that their numerical analysis could be misleading. If the circumscription of Chaetopsina proposed in the present paper, and based on relationship to closely related species of Nectria, is accepted then none of the characters given great--or even moderate--weight by DiCosmo et al. (1983) are highly significant. The four Chaetopsina anamorphs are held together by the rather subtle feature of pigmentation of the setose conidiophore. Using traditional concepts of anamorph taxonomy or the more sophisticated numerical analysis of DiCosmo et al. these anamorphs would have been classified in two or more genera.

MATERIALS & METHODS

Single ascospores were isolated on cornmeal dextrose agar (CMD Difco) with the aid of a micromanipulator. Colonies were studied on

CMD, potato dextrose agar (PDA Difco) and oatmeal agar (OA Difco). Except where noted, colonies were grown for 10 days at 20°C, 12 h darkness alternating with 12 h cool white fluorescent + near-ultraviolet light. Dried specimens were rehydrated in 3% KOH. All measurements were made from material mounted in 100% lactic acid. Selected cultures are maintained in the American Type Culture Collection (ATCC).

DESCRIPTIONS OF THE SPECIES

1. *Nectria chaetopsinae* Samuels, sp. nov. Fig. 1.

Perithecia solitaria, superficialia, pyriformia, (128-)139-190(-205) x (115-)122-180(-185) μm , sicca rubra; in aqua vel potassii hydroxidi solutione humectata rubra, in acidis lactico lutescens; apice acuto. Asci clavati, (35-)38-43(-45) x 4.5-6.0(-8.0) μm , unitunicati, octospori, apice ab annulo refractili cincto. Ascosporae biseriatae, ellipticae, (7.0-)7.8-9.3(-10.0) x 1.9-2.7(-3.0) μm , aequaliter bicellulares, leves, hyalinae.

In foliis *Collospermi hastati* crescens.

Holotypus: PDD 44237, Isotypus: NY.

Status anamorphosus: *Chaetopsina* cf. *fulva* Rambelli, Atti Accad. Sci. Bologna 15: 5. 1956.

Conidiophores mononematous, scattered, setiform, erect, unbranched, red-brown, becoming yellow in 100% lactic acid, 200-230 μm long, tapering from 8-10 μm wide just above the swollen, 10-15 μm wide base to 4-5 μm wide at tip; wall ca. 2 μm wide at base, thinning to <0.5 μm wide at tip; apex sterile; bearing a few short lateral branches at or below the middle; branches formed of many small, <5 μm wide, thin-walled, non-pigmented cells, each cell producing one or more phialides; phialides densely clustered, subglobose to ampulliform, (10-)15-20(-22) μm long x 2.5-3.0 μm wide at base, monoblastic, tip 0.5-1.0 μm wide, lacking obvious periclinal thickening, not flared. Conidia oblong, (5.0-) 5.6-7.2(-8.5) x 1.0-1.3(-1.7) μm , lacking an obvious basal abscission scar, unicellular, hyaline, held in colorless slime. Sterile setae abundant, similar to conidiophores but lacking phialides and conidia.

Perithecia scattered, solitary, superficial, non-stromatic, mycelium not evident; pyriform, apex acute, not collapsing when dry, smooth, red; remaining red in 3% KOH, becoming yellow in 100% lactic acid, (128-)139-190(-205) μm high x (115-)122-180(-185) μm wide.

Cells at surface of perithecial wall textura epidermoidea, walls unevenly thickened, adjacent cells connected by pores or very thin regions of the wall. Perithecial wall ca. 10 μm wide, formed of a single region of intertwined hyphae; cells in section elliptical to fusiform, lumens 5-8 μm long x 1-2 μm wide; wall ca. 2 μm thick, pigmented; cells of inner ca. 5 μm elongated to fusiform, wall <0.5 μm thick, non-pigmented. Perithecial apex comprising $\pm$ elliptical cells at the surface; cells within arranged in a palisade of hyphae with rounded, 1-2 μm wide tips; hyphal elements merging with periphyses within. Perithecia anchored to substrate by hyphae arising from surface of lower perithecial wall.

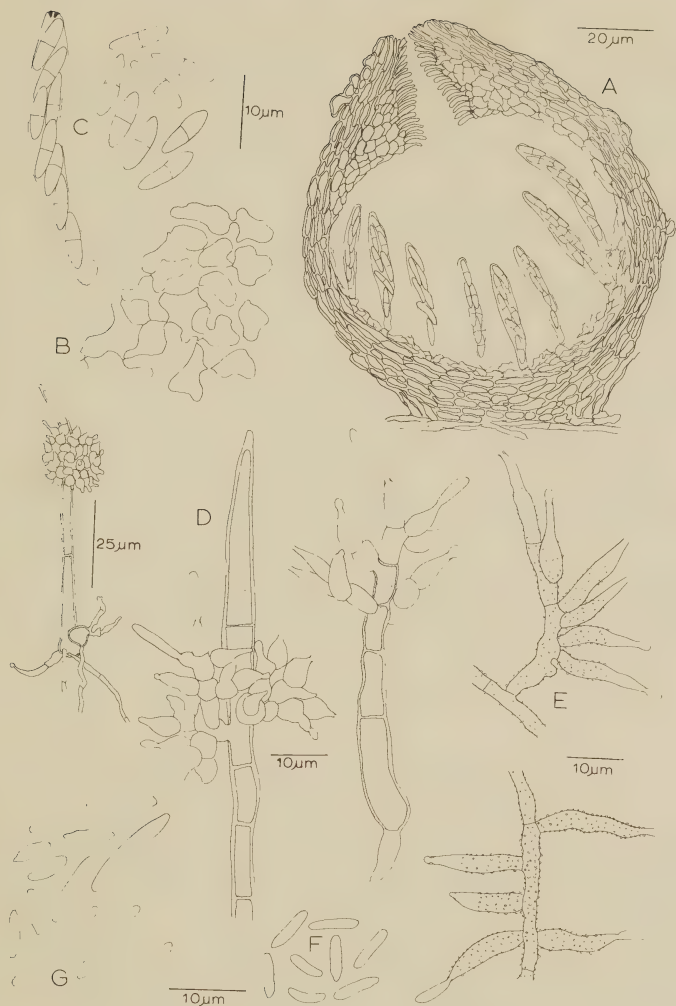


Fig. 1. *Nectria chaetopsinae*. A. Median longitudinal section of mature perithecialium (GJS 83-105). B. Surface of perithecial wall (GJS 83-105). C. Asci and ascospores (GJS 83-105). D. Setose conidiophores from culture (conidiophore on right from GJS 83-105, otherwise from GJS 161). E. Micronematous conidiophores from culture (GJS 83-161). F. Conidia from nature (GJS 83-105). G. Conidia from culture (GJS 83-105).

Asci clavate, (35-)38-43(-45) $\times$ 4.5-6.0(-8.0) μ m, apex with a ring; 8-spored, ascospores 2-seriate, entirely filling each ascus or up to 10 μ m of ascus base empty.

Ascospores elliptical, (7.0-)7.8-9.3(-10.0) $\times$ 1.9-2.7(-3.0) μ m, equally 2-celled, not constricted at the septum, smooth, hyaline.

CHARACTERISTICS IN CULTURE. CMD, PDA; OA: ca. 1 cm diam, flat, waxy, opaque, lacking aerial mycelium, Sienna (Rayner 8) in center, margin white (on PDA, entire colony white). Conidiophores forming profusely on all media, macronematous, mononematous, setose, unbranched, smooth; red-brown, becoming yellow in 100% lactic acid, (107-)125-165(-175) μ m long $\times$ 10-12 μ m wide at base $\times$ 4-5 μ m wide at subacute tip, (1-)6-9-septate; wall ca. 3 μ m wide at base $\times$ < 0.5 μ m wide at apex. Phialides arising in a compact cluster in the upper third of the conidiophore, less frequently terminating the conidiophore. Phialides arising from short, thin-walled, non-pigmented lateral branches of the conidiophore, with an enlarged, ca. 3 μ m wide, subglobose base and an abruptly narrowed, 1 μ m wide neck, smooth, thin-walled, non-pigmented, tip lacking periclinal thickening or periclinal thickening barely visible, not flared. Phialides also arising singly or in $\pm$ verticillately branched whorls of 2-3 from hyphae on surface of agar, subglobose to ampulliform, (10-)15-20(-22) μ m long; tip 1 μ m wide, with periclinal thickening; base 1.5-2.0 μ m wide, smooth or with yellow (in lactic acid) granular incrustations along the lower 2/3 of the phialide and subtending hypha. Conidia oblong to cylindrical, (6.5-)9.3-17.3(-22.0) $\times$ 2.0-2.5(-3.0) μ m, lacking an obvious basal abscission scar, unicellular, hyaline.

HABITAT. Decaying leaves of Collospermum hastatum (Col.) Skottsb. and Astelia sp.

KNOWN DISTRIBUTION. Anamorph cosmopolitan, teleomorph known only from New Zealand.

HOLOTYPE. NEW ZEALAND: Gisborne, Urewera National Park, Lake Waikaremoana, vic. park headquarters, track to Lake Ruapani, on decaying leaf of Collospermum hastatum, G.J. Samuels (83-105), P.R. Johnston, T. Matsushima & A.Y. Rossman, 31 May 1983 (PDD 44237; ISOTYPE: NY).

ADDITIONAL SPECIMEN EXAMINED. NEW ZEALAND: Gisborne, Urewera National Park, Lake Waikaremoana, track to Lake Waikare-iti, on decaying leaf of Astelia sp., G.J. Samuels (83-161), P.R. Johnston, T. Matsushima & A.Y. Rossman, 29 May 1983 (PDD 44236).

NOTES. Conidiophores formed in culture paralleled those found in nature except that in nature phialides were strictly terminal whereas in culture they were either terminal or intercalary. Cultures were made from ascospores isolated from both of the collections cited above; unfortunately these cultures have been lost. Dried cultures are deposited with the specimens deposited in PDD.

2. Nectria chaetopsinae-polyblastiae Samuels, sp. nov. Figs. 2,3.

Nectria chaetopsinae similis, sed perithecia 145-160 x 115-145 um; asci (41-)43-56(-60) x 10-13 um; ascospores angustae ellipticae vel oblongae, (7.5-)11.2-14.8(-16.0) x 3.0-3.5 um.

In corticibus ignotis crescens.

Holotypus. Samuels 1891: VEN; Isotypus: NY.

Status anamorphosus: Chaetopsina polyblastiae Samuels, sp. nov.

Setae singularitim dispersae, erectae, rectae, septatae, laeves, crasse tunicatae; rubro brunneae, in acidis lactico lutescens, 145-160 um longae, 4-5 um crassae, basi 10-15 um crassae. Rami conidiophori e apice gerentes, exiles, hyalini. Phialides monoblasticae vel polyblasticae, 12-20 um longae, superne 1.5-2.0 um, inferne 2.5-3.0 um. Conidia oblonga vel elliptica, (5.5-)7.0-9.0 x 2.5-3.0 um (in vivo), (11.0-)17.6-25.4(-27.0) x 4.0-5.3(-6.0) um (in vitro) unicellularia, hyalina.

In corticibus.

Holotypus. Dumont-VE 6914: NY.

Status teleomorphosus. Nectria chaetopsinae-polyblastiae Samuels

Conidiophores red-brown, yellow in 100% lactic acid, erect, setose, septate, 145-160 um long with base bulbous, 10-15 um wide x 4-5 um wide at tip, wall 1.5-2.0 um thick; apically branched; branches thin-walled, non-pigmented, ca. 100 um long, each bearing several lateral phialides. Phialides 12-20 um long, tapering from 2.5-3.0 um wide at base to 1.5-2.0 um wide at tip, polyblastic with both terminal and lateral conidiogenous loci, or monoblastic, apex with periclinal thickening, collarette flared or not. Conidia oblong to elliptical, lacking an obvious basal abscission scar, (5.5-)7.0-9.0 x 2.5-3.0 um, unicellular, hyaline.

Ascomata solitary, scattered, superficial, non-stromatic, difficult to remove from substrate with base sometimes partially immersed in substrate; red above, orange to red below, uniformly red in 3% KOH, yellow in 100% lactic acid; pyriform with an acute apex, not collapsing when dry, 145-160 um high x 115-145 um wide, smooth.

Ascomatal wall ca. 10 um wide. Cells at surface of wall textura epidermoidea, walls unevenly thickened, < 3 um wide. Ascomatal wall in longitudinal section comprising a single region of + intertwined hyphae appearing as elliptical or flattened cells 8-10 um long with lumens < 5 um wide, or narrow, 1 um wide; walls 1.0-1.5 um thick, cells becoming progressively more flattened toward the interior of the wall. Ostiolar area composed of + vertically oriented cells; cells becoming progressively more hyphal, merging with periphyses at ostiolar canal. Ascomata anchored to substrate by a minute basal stroma comprising thin-walled textura epidermoidea.

Asci clavate, (41-)43-56(-60) x 10-13 um, apex with a ring; 8-spored, ascospores 2-seriate above, 1-seriate below, completely filling each ascus.

Ascospores narrowly ellipsoidal to oblong, (7.5-)11.2-14.8(-16.0) x 3.0-3.5 um, equally 2-celled, not constricted at the septum, smooth, hyaline.

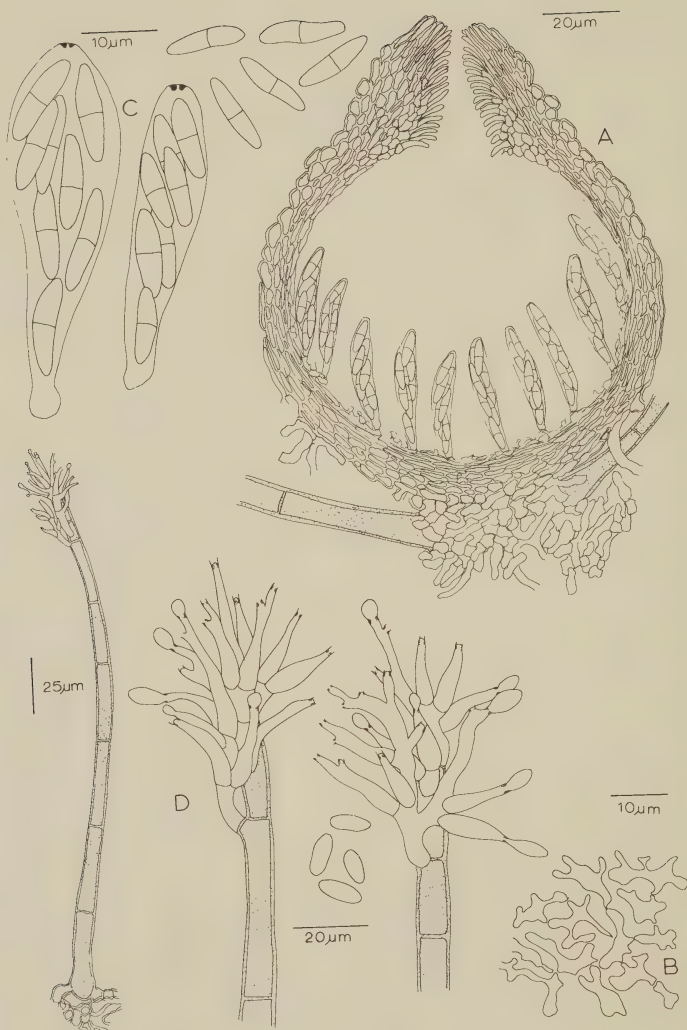


Fig. 2. *Nectria chaetopsinae-polyblastiae*. A. Median longitudinal section of mature perithecium (Dumont-EC 886). B. Surface of perithecial wall (Dumont-EC 886). C. Asci and ascospores (Dumont-VE 6914 a). D. Conidiophores and conidia (Dumont-VE 6914 a).

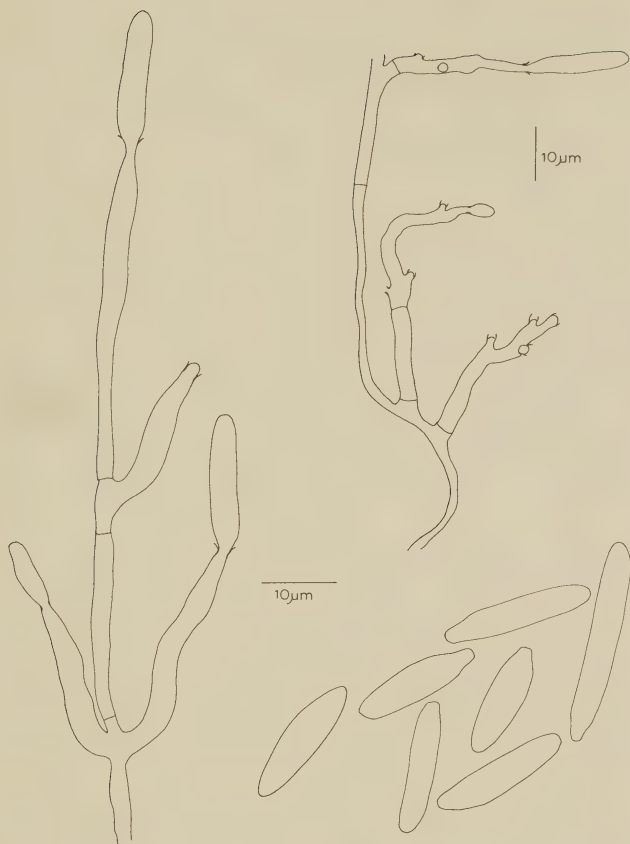


Fig. 3. Nectria chaetopsinae-polyblastiae. Conidia and conidiophores in culture. (Samuels 1891).

CHARACTERISTICS IN CULTURE. CMD: 1 cm, flat, opaque; reddish (approximately Rayner 42: Apricot) in the center, white elsewhere; aerial mycelium scant, hyphae short. PDA: 1.5 cm, flat, opaque, Rust (Rayner 39) in the center, white elsewhere; colony surface velvety, aerial hyphae short; Amber pigment (approximately Rayner 47) diffusing. OA: 1.5 cm, flat, white; aerial hyphae scant, short. Conidiophores forming profusely on all media, arising from aerial hyphae and from surface of agar; micronematous, mononematous, smooth, colorless, 12-45 µm long x 1.5 µm at tip x 2-4 µm wide at base, septate or not at base and comprising a single phialide, less frequently once branched and each branch a phialide; phialides at

first monoblastic, becoming polyblastic, tip with slight periclinal thickening. Scattered, setose conidiophores as found in nature forming on OA within 10 days and on PDA within one month. Conidia cylindrical to narrowly elliptical, (11.0-)17.6-25.4(-27.0) $\times$ 4.0-5.3(-6.0) μm ; base round or with a slightly protuberant, flat, 1.5 μm wide abscission scar; unicellular, hyaline.

HABITAT. On bark and decaying palm debris.

KNOWN DISTRIBUTION. Brazil, Ecuador, Venezuela, Colombia.

HOLOTYPE. VENEZUELA: T.F. Amazonas, Cerro de la Neblina, along Rio Mawarinuma at a point ca. 3 km E of Base Camp (00° 50'N, 66° 10'W), on decaying palm midribs, G.J. Samuels 1891 (84-4), 5 May 1984 (VEN, ISOTYPE: NY).

ADDITIONAL SPECIMENS EXAMINED. BRAZIL: Estado do Amazonas, base of W facing talus slope of Serra Araca, near central portion of serra ca. 45 min walk from lower air strip; 0°45'N, 63°19'W; alt. ca. 60 m, on palm, G.J. Samuels 569, 28 Feb 1984 (INPA, NY). COLOMBIA: Dpto. Meta, vic. km post 18 from Villavicencio, on the Villavicencio-Bogota Road via. Caqueta, elev. 4200 ft., on indet. palm frond, K.P. Dumont (Dumont-CO 2405), P. Buritica & J.L. Luteyn, 11 Jan 1976 (NY). ECUADOR: Prov. Pichincha, Rio Palenque Biology Station, 56 km from Quevedo on Santo Domingo-Quevedo Road, on indet. bark, K.P. Dumont (Dumont-EC 886), S.E. Carpenter & P. Buritica, 21 Jul 1975 (NY). VENEZUELA: Edo. Bolivar, trail up N facing slope of Uei Tepui, from old military camp "Ciento Veinticinco", ca. 118 km S of El Dorado, on road between El Dorado and Sta. Elena, on unidentified bark, K.P. Dumont (Dumont-VE 6914 a), R.F. Cain, G.J. Samuels, & C. Blanco, 5 Aug 1972 (NY); T.F. Amazonas, Cerro de La Neblina, three collections with location as holotype: on decaying palm sheathing base, G.J. Samuels 1888 A, 5 May 1984 (NY); on bark, G.J. Samuels 1902 (84-3), 5 May 1984 (NY, VEN); on wood, G.J. Samuels 1754 A, B. Stein, & W. Thomas, 1,2 May 1984 (NY).

NOTE. Ascospores of Samuels 1902 were larger than is usual for the species but cultures derived from single ascospores of this collection were identical to those produced by Samuels 1891, the holotype.

3. Nectria chaetopsinae-penicillatae Samuels sp. nov. Fig. 4.

Nectria chaetopsinae similis, sed perithecia (266-)288-345 $\times$ (220-)228-260 μm ; asci (80-)93-114(-120) $\times$ (14-)18-22(-23) μm , apice simplices; ascosporae fusiformes, (19-)24.8-41.9(-48.0) $\times$ (5.5-)5.8-9.8(-11.0) μm , crasse striatae.

In corticibus Beilschmiedia tawa.

Holotypus. PDD 44235.

Status anamorphosis. Chaetopsina penicillata Samuels sp. nov.

Setae singularitit dispersae, erectae, rectae, septatae, laeves, crasse tunicatae; rubro brunneae, in acidis lactico lutescens, 350-370 μm longae, superne ca. 10 μm crassae, basi 15-25 μm crassi. Phialides e apice gerentes, in penicilli ordinati. Penicilli

biverticillati, 1^o metulae 10-15 x ca. 4 μ m, 2^o metulae 8-10 x ca. 4 μ m; phialides cylindricae vel ampulliformes, 10-15 x 3-4 μ m. Conidia ellipticae vel subfusiformes, (8.0-)9.4-22.9(-26.0) x (5.0-)5.9-10.3(-11.0) μ m.

In ramunculo.

Holotypus. Dumont-EC 609: NY.

Status teleomorphosus. Nectria chaetopsinae-penicillatae Samuels

Conidiophores scattered, mononematous, erect, setose, unbranched, septate and appearing segmented; red-brown, becoming yellow in 100% lactic acid; walls 2-3 μ m thick, 350-370 μ m long, tapering from 15-25 μ m wide base to ca. 10 μ m wide at tip, bearing a single, terminal, colorless, slimy head of conidia on a ca. 25 μ m wide penicillus of phialides. Penicillus biseriate, 2-4 primary metulae arising from tip of conidiophore; primary metulae, cylindrical, 10-15 μ m long x ca. 4 μ m wide, each bearing 2-5 secondary metulae at its tip; secondary metulae cylindrical, 8-10 μ m long x ca. 4 μ m wide, each bearing ca. 4 phialides. Phialides cylindrical to ampulliform, 10-15 x 3-4 μ m wide, with pronounced periclinal thickening at the tip and a flared collarette. Metulae and phialides thin-walled and non-pigmented. Conidia elliptic to subfusoid, tips rounded to subacute, base rounded or with a flat, protuberant abscission scar, (8.0-)9.4-22.9(-26.0) x (5.0-)5.9-10.3(-11.0) μ m, unicellular, hyaline. Sterile setae present, similar to conidiophores.

Perithecia solitary, scattered, superficial, seated on an inconspicuous, non-erumpent basal stroma; red or red above and yellow below, becoming uniformly red in 3% KOH and yellow in 100% lactic acid, pyriform with an acute apex, smooth, not collapsing when dry, (260-)288-345 μ m high x (220-)228-260 μ m wide.

Cells at surface of perithecial wall textura epidermoidea, adjacent cells joined by a pore, walls 1.5-2.0 μ m thick. Perithecial wall ca. 15 μ m wide, cells at surface, when seen in section, with flat to circular, 2-5 μ m wide lumens, walls 1.5-2.0 μ m thick, cells becoming progressively more flattened and thin-walled toward the perithecial locule; perithecial apex comprising a palisade of parallel, hyphal elements with narrow lumens and rounded tips, walls 1-2 μ m thick, elements becoming progressively thinner and more thin-walled toward the ostiolar canal, merging with periphyses.

Asci clavate, (80-)93-114(-120) x (14-)18-22(-23) μ m, apex simple, 3-8-spored, sometimes with 4 normal spores and 4 aborted spores, ascospores biseriate, completely filling each ascus.

Ascospores fusiform, (19.0-)24.8-41.9(-48.0) x (5.5-)5.8-9.8(-11.0) μ m, equally 2-celled, not constricted at the septum, with ridge-like striations, hyaline.

CHARACTERISTICS IN CULTURE. CMD: 1.5 cm diam., flat, transparent, scant, aerial mycelium white, colony white to pale Sienna (Rayner 8), reverse concolorous, some brown pigment spreading into the medium. PDA: 1 cm diam, flat; scant, aerial mycelium scant, white, surface of colony Sienna (Rayner 8), reverse concolorous, Sienna pigment spreading into the medium. OA: 1 cm diam, as PDA but pigmentation less intense, pale red-brown pigment spreading through the medium.

Conidial production abundant on all media. Conidiophores scattered, mononematous, unbranched, stiff, erect, red-brown, 150-230 μm long with base ca. 10 μm wide, wall ca. 2 μm thick; a single, compact penicillus formed at the tip of each conidiophore. Penicillus biseriate, ca. 4 primary metulae arising from the tip of each conidiophore; primary metulae cylindrical, 10-15 μm long x ca. 5 μm wide, each bearing 2-3 secondary metulae or 2-4 phialides; secondary metulae cylindrical, 10-15 long x ca. 5 μm wide, each bearing 2-4 phialides. Phialides cylindrical, 12-16 x 4-5 μm , with periclinal thickening at the tip and a flared, sometimes funnel-shaped, collarette. Phialides also arising from vegetative hyphae, 12-30 μm long x 2-4 μm wide, slight periclinal thickening at tip; collarette flared, often cupulate. Conidia $\pm$ elliptical with apex round or acute and papillate, base round or with a protuberant, flat basal abscission scar, (13.0-17.6-22.3(-25.0) x (6.0-6.8-8.2 μm , unicellular, smooth, hyaline, produced in basipetal succession and held in a colorless drop of slime at the tip of each conidiophore and forming a continuous layer of white slime on surface of colony.

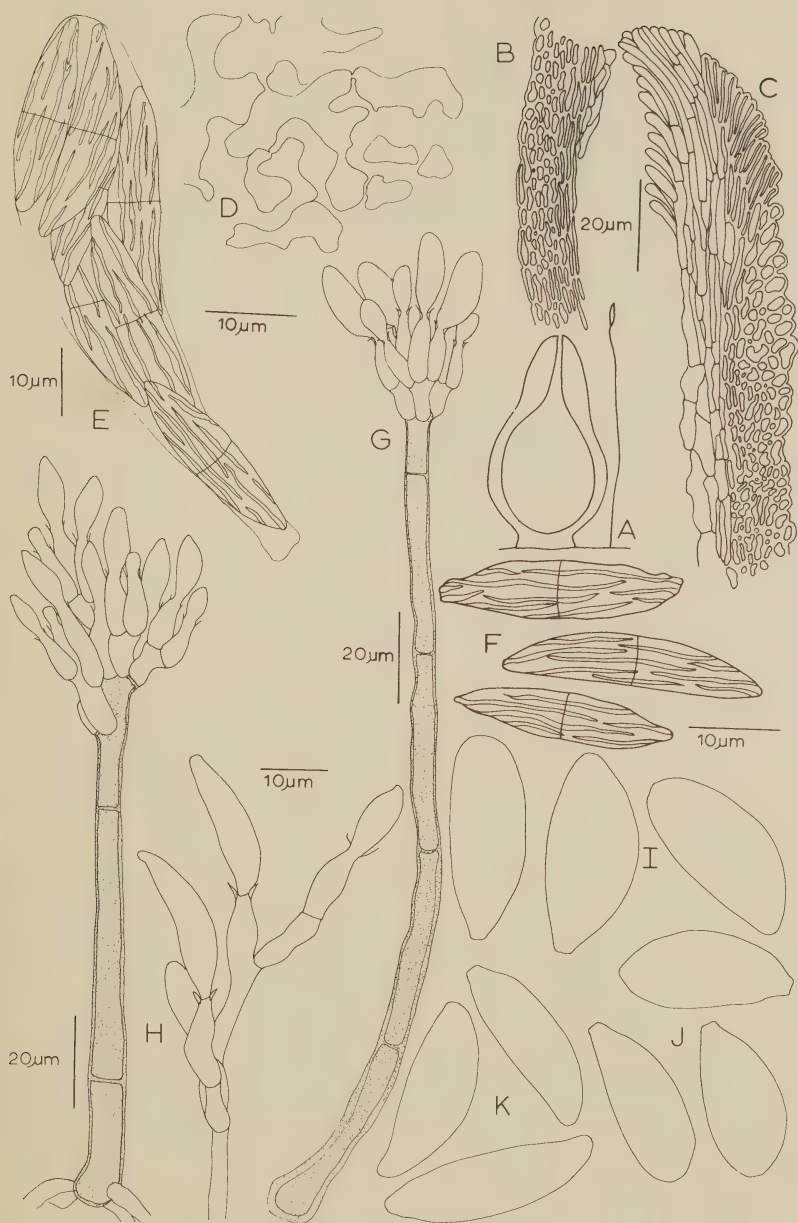
HABITAT. Bark of Beilschmiedia tawa (A. Cunn.) Kirk and sheathing base of palm frond (Rhopalostylis sapida Wendl. & Drude).

KNOWN DISTRIBUTION. Ecuador, Jamaica, New Zealand.

HOLOTYPE. NEW ZEALAND: Auckland, Waitemata City, Waitakere Ranges, Piha Rd., Marguerite Track, on bark of Beilschmiedia tawa, G.J. Samuels (77-21), 21 Mar 1977 (PDD 44235, PDD Culture Collection 7801, ATCC 56205).

ADDITIONAL SPECIMENS EXAMINED. ECUADOR: Prov. Pichincha, 24 km above Toachi on the Toachi-Palo Quemado Rd., elev. ca. 3400 ft., on twig, K.P. Dumont (Dumont-EC 609), S.E. Carpenter, P. Buritica, 19 Jul 1975 (NY, PDD 44233). JAMAICA: St. Andrew's Parish along Wag Water River, near source, Holywell Recreation area, elev. 2800-3000', on bark, R.P. Korf, J.R. Dixon, K.P. Dumont, R.W. Erb, D.H. Pfister, D.R. Reynolds, A.Y. Rossman & G.J. Samuels, 11 Jan 1971 (NY: CUP-MJ 797). NEW ZEALAND: Waitemata City, Waitakere Ranges, Piha Rd., Marguerite Track, on sheathing base of Rhopalostylis sapida, G.J. Samuels (80-54) & B. Kendrick, 14 Mar 1980 (PDD 44234, PDD Culture Collection 7802).

Fig. 4. Nectria chaetopsinae-penicillatae. A. Diagram of perithecium with adjacent conidiophore (GJS 77-21). B. Portion of lateral wall of perithecium (GJS 77-21). C. Portion of ostiolar region of perithecium (GJS 77-21). D. Surface of perithecial wall (GJS 77-21). E. Ascus (GJS 77-21). F. Ascospores (GJS 77-21). G. Conidiophore from nature (Dumont-EC 609). H. Setiform and micronematous conidiophores formed in culture (GJS 80-54). I. Conidia from nature (Ecuador, Dumont-EC 609). J. Conidia from nature (New Zealand, GJS 80-54). K. Conidia from culture (New Zealand, GJS 80-54).



4. Nectria chaetopsinae-catenulatae Samuels, sp. nov. Figs. 5,6.

Nectria chaetopsinae similis, sed perithecia 250-280 x 145-280 μm et cum disco osteolari instructi; asci (44-)53-73(-90) x (5.0-)6.5-9.0(-10.0) μm ; ascospores fusiformes vel ellipticae, (10.0-)10.6-13.2(-15.0) x (3.0-)3.3-4.3(-5.0) μm .

In corticibus.

Holotypus. Dumont-VE 1256: NY.

Status anamorphosus. Chaetopsina catenulata Samuels sp. nov.

Setae singularitim dispersae, erectae, rectae, septatae, laeves, crassa tunicatae; rubro brunneae, in acidis lactico lutescens, 350-450 μm longae, supernae 7-8 μm crassae, basi ca. 15 μm crassi. Rami conidiophori e apice gerentes, exiles, hyalini, in verticilli ordinati. Phialides monoblasticae, ca. 25 μm longae, superne ca. 2 μm crassae, infernae 4-5 μm crassae. Conidia oblonga, (8-)12-16(-21) x 2.5-3.5(-5.0) μm , uni- vel bicellularia, portata in catenis.

In corticibus.

Holotypus. Dumont-VE 1256: NY.

Status teleomorphosus. Nectria chaetopsinae-catenulatae Samuels.

Conidiophores mononematous, setiform, erect, red-brown, becoming yellow in 100% lactic acid, 350-450 μm long x ca. 15 μm wide at base x 7-8 μm wide at tip, wall 2-3 μm wide at base and ca. 1 μm wide at tip, septate, frequently appearing segmented, smooth, producing a few thin-walled, non-pigmented branches from the apex, each branch bearing 1-5 phialides in verticils; phialides monoblastic, subulate, ca. 25 μm long x 4-5 μm wide at base x 2 μm wide at tip; tip with periclinal thickening, not flared. Conidia oblong, (8-)12-16(-21) x 2.5-3.5(-5.0) μm , with a protuberant, flat scar at each end or apex round and base with a flat, protuberant scar, 0-1-septate, hyaline. Sterile setae not seen.

Perithecia superficial or with base partially immersed in substrate, non-stromatic but difficult to remove from substrate, solitary and scattered or, less frequently, cespitose in clusters of a few, globose to broadly pyriform with a broad, obtuse apex; red, remaining red in 3% KOH, becoming yellow in 100% lactic acid, smooth, collapsing by slight lateral pinching or not collapsing when dry, 250-280 μm high x 145-280 μm wide, apex 80-125 μm diam.

Cells at surface of perithecial wall textura epidermoidea, 10-20 μm across, walls 2-3 μm thick; adjacent cells joined by pores. Perithecial wall 30-35 μm wide comprising a single region of intertwined hyphae, cells in section elliptical, 8-25 μm long x ca. 10 μm wide, walls 1.5-2.0 μm thick, pigmented; cells of inner ca. 10 μm flat, compressed, thin-walled, non-pigmented. Papillum composed of a palisade of hyphal elements with tips round, ca. 6 μm wide; walls of hyphal elements at exterior 1.5-2.0 μm thick becoming progressively more thin-walled toward the ostiolar canal and there merging with periphyses.

Asci clavate, (44-)53-73(-90) x (5.0-)6.5-9.0(-10.0) μm , apex with a small ring; 8-spored, ascospores 2-seriate above, 1-seriate below, completely filling the ascus. Ascospores fusiform to elliptical,

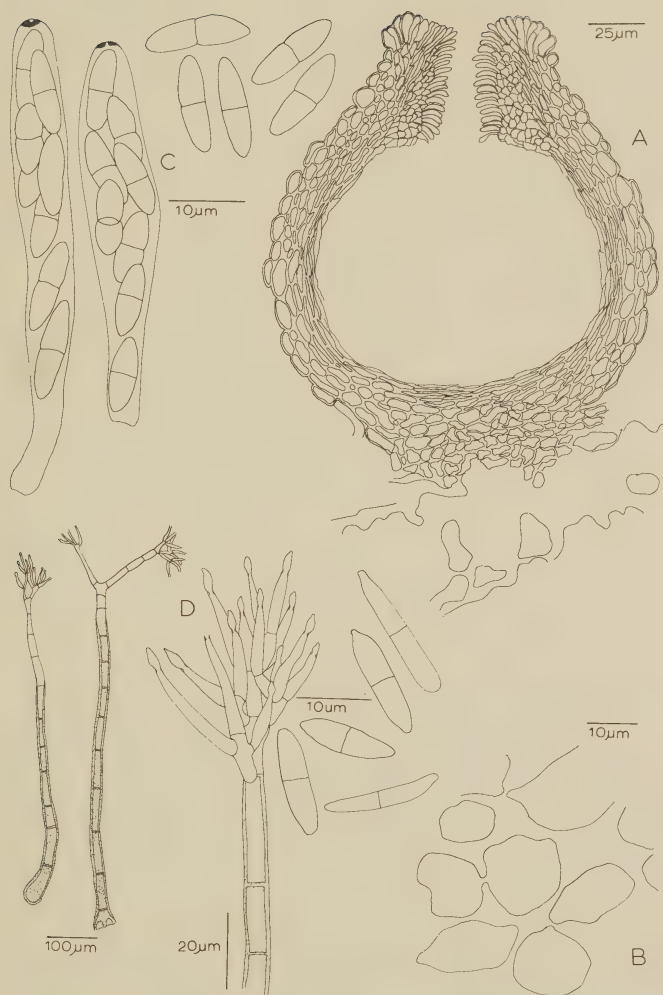


Fig. 5. *Nectria chaetopsinae-catenulatae*. A. Median, longitudinal section of mature perithecium. B. Surface of perithecial wall. C. Asci and ascospores. D. Conidiophores from nature. (all figures from Dumont-VE 1256).

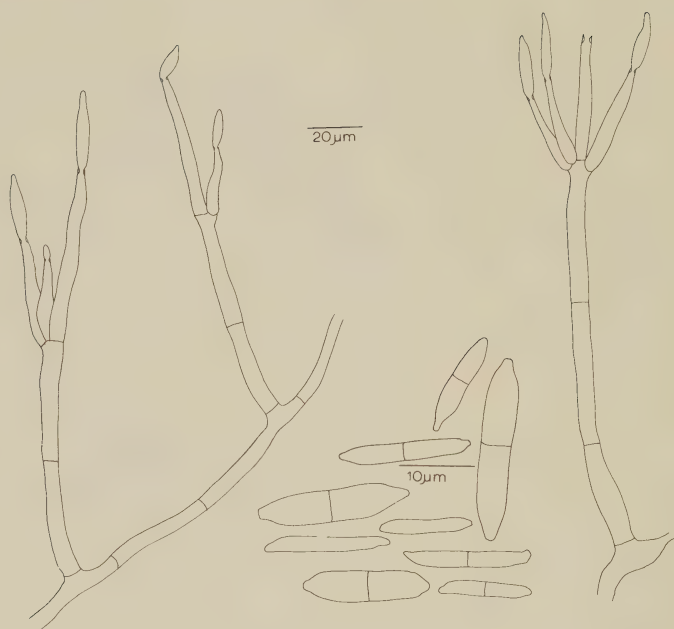


Fig. 6. *Nectria chaetopsinae-catenulatae*. Conidia and conidiophores from culture (CTR 71-245).

(10.0-)10.6-13.2(-15.0) $\times$ (3.0-)3.3- 4.3(-5.0) μm , equally 2-celled, not constricted at the septum, hyaline, smooth.

CHARACTERISTICS IN CULTURE. CMD: 2-3 cm diam, flat, translucent, aerial mycelium short, cottony, white, colony reverse white. PDA: 2-3 cm diam, flat, aerial hyphae short, cottony, white, surface of colony approximately Sienna (Rayner 8), reverse approximately Ochreous (Rayner 44). OA: 3 cm diam, flat, aerial hyphae consisting of barraging, dendroidal, rope-like strands arranged in 1-2 concentric rings near the edge of the colony, surface of colony dark, Sienna (Rayner 8) to Umber (Rayner 9). Conidiophores forming abundantly on all media in aerial mycelium and on surface of colony; surface of colony slimy from conidia. Distinctly setose conidiophores not forming in culture but many conidiophores pigmented very pale red-brown. Conidiophores 50-180 μm long, unbranched, sparingly branched, each branch bearing a single phialide or a verticillate or penicillate whorl of up to 6 phialides. Phialides 12-50 μm long, often with a long phialide in the middle of a whorl of phialides, 1.5-2.0 μm at tip $\times$ 2.0-3.5 μm wide at base, straight, smooth, tip with periclinal thickening, not flared. Conidia oblong to fusiform,

(6.5-)10.2-19.5(-23.0) $\times$ (1.5-)1.9-3.5(-4.5) μ m, with a flat protuberance at each end, 0-1-septate, hyaline, smooth, held in chains that slime down.

HABITAT. Bark and ascomycetous stromata.

KNOWN DISTRIBUTION. Ecuador, Jamaica, Venezuela.

HOLOTYPE. VENEZUELA: Edo. Aragua, 2-3 km along trail behind hotel, up Mt. Guacamaya, Rancho Grande, Parque Nac. Henry Pittier, on unidentified wood, K.P. Dumont (Dumont-VE 1256), J.H. Haines & G.J. Samuels, 4 Jul 1971 (NY, CTR 71-245, ATCC 56204).

ADDITIONAL SPECIMENS EXAMINED. ECUADOR: Prov. Morona Santiago, ca. 5 km from Limon (General Plaza Guiterrez), on the Limon-Mendez road, elev. ca. 4,000 ft., on branch, K.P. Dumont (Dumont-EC 2043), S.E. Carpenter & P. Buritica, 3 Aug 1975 (NY). JAMAICA: Boundary between St. Andrew and Portland Parish, along Lady's Mile trail to just S of Woodcutter's Gap, vic. Newcastle, on stromatic pyrenomycete, R.P. Korf, J.R. Dixon, K.P. Dumont, R.W. Erb, D.H. Pfister, D.R. Reynolds, A.Y. Rossman & G.J. Samuels, 9 Jan 1971 (NY: CUP-MJ 745, CTR 71-23; Rossman 373, ATCC 56203). VENEZUELA: Edo. Miranda, road between Agua Blanco and Parq. Nac. Guatopo at Oficina, Parq. Nac. Guatopo, on unidentified bark, K.P. Dumont (Dumont-VE 942), J.H. Haines & C. Blanco, 29 Jun 1971 (NY, VEN, NYS).

NOTE. Few setose conidiophores formed in pure cultures of this species and these were only very lightly pigmented. Conidia on these conidiophores were held in chains that slimed down to form heads. Conidia in nature are also held in chains.

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THE NEMATODE PARASITE MERIA CONIOSPORA DRECHSLER IN PURE CULTURE AND ITS CLASSIFICATION

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Meria coniospora was accurately described by Drechsler (1941) as an endoparasite of *Rhabditis* spp. and other nematodes, but not studied in pure culture. This fungus is unique because of its conical conidia which tend to stick with their pointed end to the oral and in some cases the tail region of Rhabditidae and other free-living nematodes (Drechsler, 1941; Barron, 1977; Dürschner, 1983; Jansson and Nordbring-Hertz, 1983). This specific attachment may be due to a lectin-carbohydrate (sialic acid) interaction (Jansson and Nordbring-Hertz, 1983, 1984). *M. coniospora* shows a high ability to infect and kill nematodes, and the strong attraction of nematodes to conidia might play an important role in this respect (Jansson, 1982a, b). In addition, the fungus exudes a mycostatic antibiotic (Barron, 1977). After the original description from the U.S.A., the fungus has been recorded from the British Isles (Duddington, 1946, 1954; Wyborn et al., 1969; Gray, 1983a, b), Canada (Barron, 1977, 1978), Denmark (Jansson, 1982a), Germany and the Netherlands (Dürschner, 1983), Japan (Saikawa, 1982 a and b) and the Antarctic South Orkney and Argentine Islands (Gray, 1982; Gray et al., 1982). It has been recorded from agricultural soils, moss cushions, compost and coniferous litter. A few authors (Barron, Jansson, Dürschner, and Saikawa, l.c.) have had pure cultures available obtained with the method described by Barron (1969) and other methods (Wyborn et al., 1969; Barron, 1977, 1978), but they did not provide a description of the fungus at the macroscopic and light-microscopic level. SEM and TEM illustrations of conidiogenous structures formed in pure culture were, however, published by Saikawa (1982a and b) and Jansson et al. (1984).

For a reassessment of the generic classification of this fascinating fungus, a description of pure cultures and the comparison with *Meria laricis* Vuill., the type species of the genus, are required. These are the aims of the present communication.

Material examined:

Meria coniospora Drechsler, CBS 615.82, isolated by S. Olsson and H.-B. Jansson, from agricultural soils in Denmark in 1978 by means of the differential centrifugation technique (Barron, 1977).

Meria laricis Vuill., CBS 216.31, isolated by T. R. Peace, 1931; CBS 298.52, isolated by E. Müller, Horgenberg, Kt. Zürich, Switzerland, May 1952; CBS 281.59-284.59, isolated by P. Biggs in Scotland and Wales, 1955-56; all from *Larix* spp. (mainly *L. europaea*).

Description of *Meria coniospora* - Fig. 1.

Colonies on MEA, OA and other media growing extremely slowly, reaching 2-3 mm diam in 10 days, 10 mm in 35 days at c. 20 °C, at first white, later becoming cream-coloured, slightly raised, powdery due to erect fertile hyphae. Colony reverse pale ochraceous. Odour very strong, fetid, suggesting dirty socks or a Mexican maize product "taco". Vegetative hyphae of regular width, 1.5-2.5 µm. Sporulation mostly by means of erect fertile hyphae, partly also submerged. Fertile hyphae not distinct from vegetative hyphae, except for the presence of lateral conidiiferous pegs in the uppermost 3-8 cells. The conidiogenous cells are thus one terminal and a number of intercalary phialides, 5-13 x 2.0-2.5 µm, with conidiiferous pegs of 1-4 x 0.6-1.0 µm, with a minute, slightly widening collarette; periclinal wall thickening inconspicuous under the light microscope (but distinct under TEM, Saikawa, 1982a). Conidia initially appearing to be formed singly on each conidiiferous peg of the conidiophore, but after a few weeks forming radiating clusters on each peg; conical, with broadly rounded base and almost pointed tip, one-celled, hyaline, smooth-walled, 1-2-guttulate, 4.5-7 x 1.5-2.0 µm in the broadest part. Aged conidia often show a slight apical swelling which appears to contain the adhesive material for attachment to nematodes. Temperature minimum for growth near 10 °C, for conidial germination near 15 °C, maximum near 27 °C (30 °C is survived for 5 days).

As there is no type specimen prepared by Drechsler accessible, we designate a dried culture of CBS 615.82 as neotype.

In contrast with *Verticillium balanoides* (Drechsler) Dowsett, Reid & Hopkin (Dowsett et al., 1982), the microscopic features of *M. coniospora* are quite constant in pure culture and on eelworms (as observed on cultures of *Panagrellus redivivus* on water agar). Our observations generally confirm Drechsler's (1941) observations from xenic cultures. The very restricted growth and the abundant sporulation in pure culture are remarkable features among the nematode parasites. Jansson (1982 b) found that the fungal biomass of nematode parasites is roughly inversely proportional to their preda-

cious ability. This organism is thus a very typical representative of the R strategy of high stress-high disturbance survivors (Pugh, 1980).

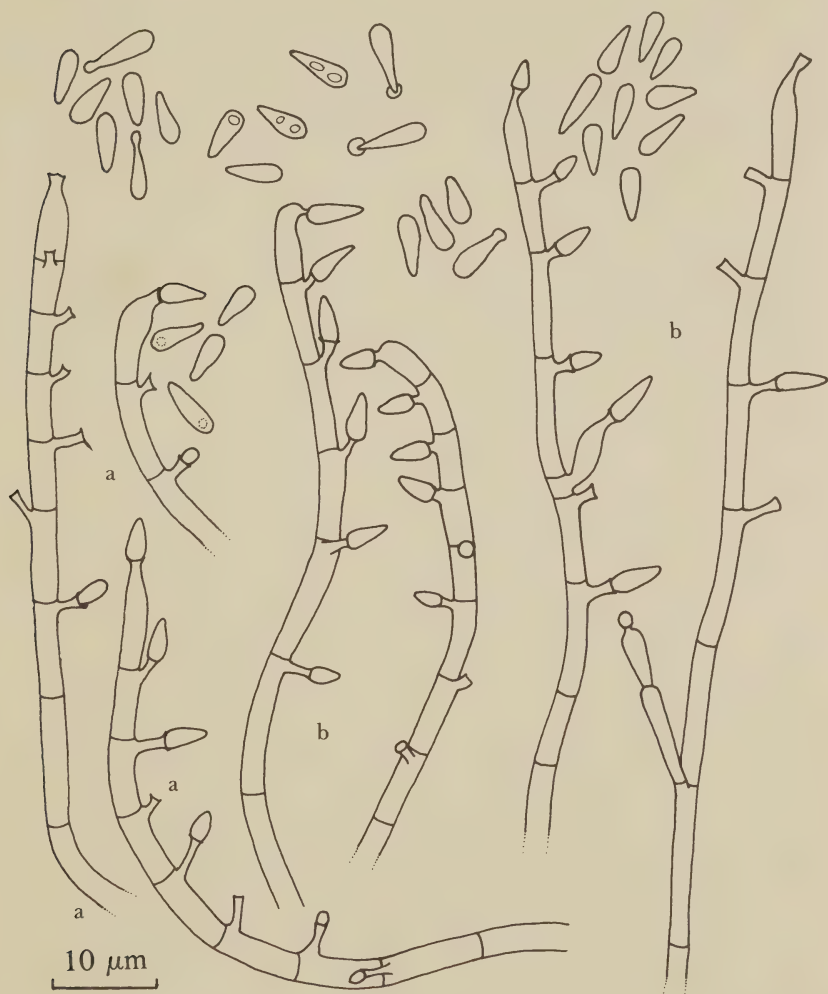


Fig. 1. — *Drechmeria coniospora*, CBS 615.82. a. from 11-day-old culture on MEA, b. from *Panagrellus redivivus* on water agar.

A swelling of the pointed apical end, the adhesive cushion, is not equally visible on all conidia, but apparently formed during maturation (as observed already by Drechsler). In 2-week-old cultures these cushions are still virtually absent. In TEM Saikawa (1982a) showed that this "maturation bud", which is involved in the adhesion to the nematodes and is always present before the attachment to the prey, consists of a mucous layer with radiating fibrils.

Meria coniospora was placed in the genus *Meria* Vuillemin (1896) by Drechsler (1941) with some hesitation. Drechsler knew the type and only species of the genus, *M. laricis* Vuill., the causal agent of needle cast of larch, only from the literature (Vuillemin, 1896, 1905; Hartig, 1899; Lindau, 1900; Peace and Holmes, 1933). Vuillemin (1896) characterized his fungus by the possession of substomatal cushions, from which fertile hyphae protrude with up to four sporiferous cells, a structure which he considered as intermediate between asci and cysts of Ustilaginales. The fungus was described in culture by Peace and Holmes (1933), who recognized the spores as being conidia. In fact the conidiogenous cells are serial phialides like in the nematode parasite. More recent descriptions are given, e.g., by Butler and Jones (1961) and Butin and Zycha (1973), while Peace and Holmes (1933), Batko (1956) and Biggs (1957) studied its variability. The cultures available at present remain mostly sterile, but grow somewhat faster than *M. coniospora* with a weekly radial increment of 4-7 mm at about 20°C. The hyphae are of very unequal width (1.5-4(-7) μ m) and rather thick-walled. After two weeks sporulation occurs in some isolates in tiny clusters of fertile hyphae on mostly discrete phialides. This observation in addition to the behaviour of this plant parasite on its host, indicates that these two fungi are not congeneric. Drechsler (1941) also compared his nematode parasite with *Dixidium dixae* Poisson (1932) which may belong to *Smittium* (Harpellales, Trichomycetes) (Manier and Lichtwardt, 1968). This fungus has even less similarity with the nematode parasite than *Meria*. Comparable acropleurogenous phialidic sporulation is also found in *Zakatoshia* Sutton, which in culture (CBS 235.82) behaves like a black yeast, not at all like *M. coniospora*. *Pseudomeria mucosa* Barron (1980) (CBS 487.83) resembles *M. coniospora* in its acropleurogenous sporulation, but the sympodial blastic conidiogenesis is very different with conidiogenous cells bearing very long conidiiferous pegs.

As no other suitable genus is available, we propose to classify *M. coniospora* in a new genus of Hyphomycetes, which we call *Drechmeria*, short for Drechsler's *Meria*.

Drechmeria gen. nov.

Genus hyphomycetum phialosporicum. Mycelium hyalinum extensione valde restrictum. Hyphis fertilibus erectis, 2-7 phialides intercalares sub una terminali ferentes; intercalares in collulum acropleurogenum angustum exeuntes; conidia successione basipetali formata, radiatim conglomerata, conica, basi rotundata, sursum quasi acutata, unicellularia, hyalina, levia.

Species typical *Drechmeria coniospora* (Drechsler) W. Gams & Jansson, comb. nov. (basionym *Meria coniospora* Drechsler, *Phytopathology* 31: 792. 1941).

A genus of phialidic hyphomycetes. Mycelium hyaline, with very restricted growth. Fertile hyphae erect, bearing one terminal and 2-7 intercalary phialides, the intercalary ones bearing acropleurogenous conidiiferous pegs below the upper septum, forming several conidia in basipetal succession, which form stellate clusters. Conidia conical, with rounded base and almost pointed tip, one-celled, hyaline, smooth-walled.

Second species:

Drechmeria harposporioides (Barron & Szijarto) W. Gams & Jansson, comb. nov. (basionym *Meria harposporioides* Barron & Szijarto, *Can. J. Bot.* 60: 1031. 1982). Although we have not seen this fungus, we trust the adequate original description and are convinced that this parasite of ciliated protozoans, which deviates from *D. coniospora* by falcate conidia, is very close to this species.

We are grateful to Dr D. W. Minter for critically reviewing our text.

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TWO PREVIOUSLY UNDESCRIBED *OIDIUM* SPECIES FROM SOUTH AFRICA

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The occurrence of *Oidium* species on *Bauhinia galpinii* N.E.Br. and *Buddleja salviifolia* (L.) Lam. has been reported before in South Africa (Doidge, 1950), but this is the first time that these fungi are described in detail. Their teleomorphic stages have never been found. Both hosts are endemic to southern and tropical Africa.

Oidium bauhiniae Gorter & Eicker sp. nov.

Mycelium amphigenum, griseolo-albidum, effusum vel densum. Hyphae plus minusve rectae, aliquando geniculatae, 3,7-7,5 μm latae, plerumque rectangulariter ramificatae. Cellulae hypharum indistinctae, circa 50-85 μm longae. Appressoria multilobata. Conidiophora hyalina, numerosa, 1-2 septata, recta, aliquando curvata, flexuosa vel prope basim geniculata 40-80 x 6-10 μm , saepe a basi ad apicem leniter crassescens. Septa ima cellularum basium 5-12 μm distantia a mycelio. Cellulae basales 20-50 x 6,2-7,5 μm , dimidio ad quadruplo sed plerumque circiter duplo longiores quam cellulae sequentes. Conidia ovoidea ad ellipsoidea, (25-)30-32,5(-45) x (13,7-)17,5(-21,2) μm , solitaria, interdum duo vel tria concatenata remanentia, structura superficialis reticulata-corrugata. Corpuscula fibrosina conspicua desunt, interdum autem granula fibrosina observantur. Ratio longitudinis/latitudinis conidiorum circa 1,75. Tubi germinativi prope apicem oriundi, alii perbreves ac terminantes in appressorium ramosum multilobatum, alii perlongi (170-)200-250(-340) μm . Haustoria globosa habentes granula vel tubercula brevia, 7,5-10 μm diam. Habitat in foliis vivis, pedicellis et fructibus *Bauhiniae galpinii* N.E.Br., Arcadia, Pretoria, mense Martio 1983, PREM No. 47466 (holotypus).

Mycelium amphigenous, grayish white, effuse to dense. Hyphae more or less straight, occasionally geniculate 3,7-7,5 μm wide, branching mostly at right angles. Hyphal cells indistinct, about 50-85 μm long. Appressoria multilobed (Fig. 1). Conidiophores hyalin, numerous, 1-2 septate, straight, occasionally bent, flexuous or geniculate near their base, 40-80 x 6-10 μm , often slightly widening from base to top (Fig. 2). Foot cells sometimes with their basal septum 5-12 μm away from the mycelium, 1,5 to 4 times the length of the following cells, mostly about twice their length,

20-50 x 6,2-7,5 μm . Conidia ovoid to ellipsoid, produced singly but under suitable conditions 2 or 3 successively produced conidia can remain together in a short chain. Surface structure shows network of ridges (Fig. 3). No well developed fibrosin bodies are present but sometimes inclusions of granular fibrosin are observed. Conidia (25-)30-32,5(-45) x (13,7-)17,5(-21,2) μm . Their length/width ratio is circa 1,75. Germ tubes subapical near end of conidia, more seldom apical, either very short and ending in a branched multi-lobed appressorium, or very long (170-)200-250(-340) μm . Haustoria globose with granula or short protuberances 7,5-10 μm in diameter.

On leaves, flower stalks and fruit of *Bauhinia galpinii* N.E.Br. Arcadia, Pretoria, March 1983, PREM No. 47466 (holotype).

Oidium buddlejae Gortner & Eicker sp. nov.

Mycelium superficiale, albidum. Hyphae hyalinae, flexuosae et geniculatae, 3,7-5 μm latae, habentes appressoria multilobata, plerumque binatim opposita et saepe aggregata. Cellulae hypharum breves, 20-45 μm . Conidiophora abundantia, 1-2 septata, geniculata, interdum curvata, raro recta, a basi ad apicem leniter crassescens, 62-162 x 8,5-11,5 μm . Cellulae basales 45-85 x 8,5-10 μm , cellulae sequentes breviores. Conidia ovoidea ad ellipsoidea, (25-)27,5-32,5(-36) x (13,7)16,2-18,7(-21,2) μm , structura superficialis praebens strias subhelicoidae. Tubi germinativi apicales vel subapicales, recti vel subflexuosi, plerumque non ramosi, 25-65 x 2,5-3,7 μm , saepe terminantes in apicem incrassatum appressorio similem (6,2-10 x 5-6,2). Conidia interdum germinantia ad utrumque extremum. Haustoria globosa vel depresso globosa, 7-10 x 7,5-12,5 μm . Habitat in foliis vivis *Buddleja salviifoliae* (L.) Lam., Arcadia, Pretoria, mense Martio 1982. PREM No. 4726 (holotypus).

Mycelium white, on axial surface. Hyphae hyaline, flexuous and geniculate, 3,7-5 μm wide with numerous multilobed appressoria, usually opposite and grouped together (Fig. 4). Hyphae cells short, 20-40 μm . Conidiophores abundant, 1-2 septate, geniculate, less commonly curved or seldomly straight, slightly widening from bottom to top, 62-162 x 8,5-11,5 μm (Fig. 5). Footcells, 45-85 x 8,5-10 μm followed by one or two shorter cells. Conidia ovoid to ellipsoid, (25-)27,5-32,5(-36) x (13,7-)16,2-18,7(-21,2) μm , surface structure slightly helicoid grooves (Fig. 6). Germ tubes apical or subapical, straight or slightly flexuous, simple or occasionally branched, 25-65 x 2,5-3,7 μm , often ending in a thickened appressorium-like hyphal point (6,2-10 x 5-6,2 μm). Conidia germinate occasionally from opposite ends. Haustoria globose to flattened-globose, 7-10 x 7,5-12,5 μm .

The characteristic geniculate foot cells of *Oidium buddlejae* resemble those of *Oidium indigoferae* described and illustrated by Yen (1966) but differs in longer conidiophores and foot cells and in wider conidia.

On leaves of *Buddleja salviifolia* (L.) Lam., Arcadia, Pretoria, March 1982, PREM No. 47216 (holotype).



Figures 1-3: *Oidium baubiniiae*, 1. appressoria, 2. conidiophores, 3. primary (right) and secondary conidium.

Figures 4-6: *Oidium buddlejae*, 1. appressoria, 2. conidiophores, 3. conidium.

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REDISPOSALS AND REDESCRIPTIONS IN
THE **MONOCHAETIA-SEIRIDIUM**,
PESTALOTIA-PESTALOTIOPSIS
COMPLEXES. I.
THE CORRECT NAME FOR THE TYPE SPECIES
OF PESTALOTIOPSIS.

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Pestalotia maculans (Cda.) Hughes
is redescribed and redisposed in
Pestalotiopsis. P. guepinii, the
type species of Pestalotiopsis), is
considered a synonym.

A review of extant mycological literature reveals a plethora of infra-generic taxa in Monochaetia (Sacc.) Allesch. (106 spp.), Seiridium Nees ex Fr. (20 spp.), and Pestalotia deNot. (600 spp.). Of these three anamorph-genera, both Monochaetia and Pestalotia have been studied extensively by Steyaert (1949, 1953 a, 1953 b, 1954, 1955, 1961), and Guba (1961). Both the authors adopted Saccardoan criteria to delimit generic and infra-generic taxa accepted by them.

Guba (1961) recognized 41 species of Monochaetia in three sections based on conidium septation. According to Sutton (1980), only the species included by Guba in the section Quinqueloculatae are probably the true Monochaetia,

while species included in the section Quadriloculatae are probably referable to Truncatella Stey. or Seimatosporium Cda., and those in the section Sexloculatae to Seiridium.

The genus Seiridium, long misinterpreted, has not been revised satisfactorily. The generic synonymy has been discussed in detail by Guba (1961), Shoemaker et al. (1966), and Sutton (1969, 1975).

Steyaert (1949) restricted Pestalotia to a single species and reassigned several species formerly disposed in Pestalotia to the new anamorph-genera Pestalotiopsis Stey., and Truncatella, but a majority of the species remained unassessed. Guba (1961) preferred to adopt a broader generic concept. He reduced Pestalotiopsis, Truncatella and Labridella to synonymy with Pestalotia and accepted 220 species in that genus. Sutton (1969) has fully discussed the arguments opposing or supporting either approach and gave evidence favouring the rearrangement proposed by Steyaert (1949).

The distinctions between the genera in the Monochaetia-Seiridium and Pestalotia-Pestalotiopsis complexes have been discussed by Sutton (1969). The value of differences in conidial wall structure between Pestalotia and Pestalotiopsis, and between Monochaetia and Seiridium has been established by ultrastructural studies (Griffiths & Swart 1974 a, 1974 b, Roberts & Swart 1980). The following generic key highlights these distinctions:

KEY TO GENERA

A. Conidial appendages lacking.....SPOROCADUS
 A. Appendages apical/ apical and basal/ basal....B

B. Conidia lacking basal appendage; apical

- appendage branched; conidia euseptate;
median cells concolorous.....TRUNCATELLA
- B. Basal appendage, when present,
exogenous and excentric; conidia usually
a mixture: some with basal appendage alone
some with both apical and basal appendages
and some without any.....SEIMATOSPORIUM
- B. Basal appendage, when present, not
exogenous but centric.....C
- C. Conidia euseptate.....D
- C. Conidia distoseptate.....E
- D. Apical appendage single and unbranched;
median cells concolourous.....MONOCHAETIA
- D. Apical appendages several in an apical
crest or in several tiers on the wall of
apical cell; median cells predominantly
versicoloured.....PESTALOTIOPSIS
- E. Conidia usually 5-septate; basal and apical
appendages single, unbranched...SEIRIDIUM
- E. Conidia 5-septate; basal and apical appendages
much branched.....PESTALOTIA

Despite wide acceptance that there is only a single species in Pestalotia, new species names are still being added to this anamorph genus, although these species appear to belong in Pestalotiopsis, Truncatella or Seiridium (Von Arx 1981; T.-Z. Huang 1982). Though several species of Pestalotia have recently been redispersed in Pestalotiopsis, many of these taxonomic decisions have been based, not on study of type specimens, but on recent collections or original published descriptions or illustrations. But even after these transfers, far too many erroneous names still remain in Pestalotia.

My studies of type specimens of several species in this group have led me to endorse Sutton's view (1980) that many of the taxa still remaining in

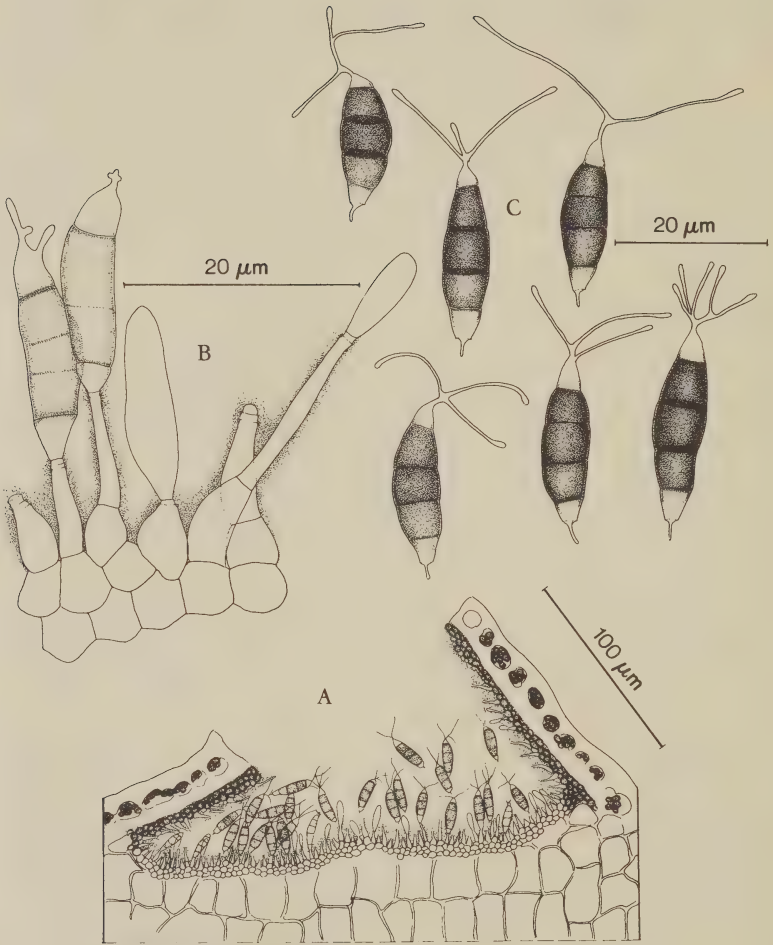


Figure 1. *Pestalotiopsis maculans* ex holotype in PR 155665. A. Vertical section of a conidioma. B. Conidiophores. C. Mature conidia.

Monochaetia and Pestalotia need to be redispersed in other genera. The current series of papers is designed to serve this need.

1. Pestalotia maculans (Cda.) Hughes
Can. J. Bot. 36: 810, 1958.

Hughes (1958) determined that the fungus, originally described by Corda (1839) as Sporocadus maculans, was a Pestalotia and published the appropriate combination for it, listing a few synonyms, but without a detailed description of the fungus. There is no reference to this binomial in the monographic account of Pestalotia by Guba (1961), although he lists a collection of Sporocadus maculans in B under Pestalotia guepinii. It is not clear from Guba's account whether this collection was part of Corda's original collection of S. maculans.

The description and the accompanying illustration (Fig. 1) presented below are based on a study of the holotype specimen in PR 155665. Clearly, the features of the fungus fit the modern generic concept of Pestalotiopsis, type sp.: P. guepinii (Desm.) Stey. Pestalotiopsis aeruginea (Stey.) Stey., P. theae (Sawada) Stey., and P. guepinii are the three species known to occur commonly on Camellia. Of these, only P. guepinii is similar to Corda's material, while the conidia of the other two species have concolourous median cells and differ in their size as well. The isotype specimen, in BPI, of P. guepinii in the exsiccati distributed by Desmazières (Pl. Crypt. Fr. 22: 1084, 1840) has been compared with the above and the two were found to be identical in all essential features. Hence, the following nomenclator is proposed:

Pestalotiopsis maculans (Cda.) comb. nov.

≡ Sporocadus maculans Cda., Icones
Fungorum 3: 24, 1839.

≡ Hendersonia maculans (Cda.)

Lév., in Sacc., Syll. Fung. 3:
427, 1894.

≡ Pestalotia maculans (Cda.)
Hughes, Can. J. Bot. 36: 810,
1958.

= Pestalotiopsis guepinii (Desm.) Stey.,
Bull. Jard. bot. Brux. 19:
300, 1949.

≡ Pestalotia guepinii Desm., Ann.
Sci. nat., ser. 2, 13: 181,
1840.

Follicolous. Conidiomata stromatic, acervuloid, amphigenous, scattered to gregarious and occasionally confluent, subepidermal in origin, erumpent, orbicular to oval in outline, 200-550 μm diam, 70-130 μm deep, glabrous, black, appearing pulvinate after dehiscence by rupture of the overlying host tissue; basal stroma 10-15 μm thick, of 'textura angularis', cells thick-walled and subhyaline; lateral walls 2-4 cells thick, with thick-walled, pale brown to brown, encrusted cells. Conidiophores formed in the concavity of the conidioma, often extending along the lateral walls, septate, unbranched, up to 30 μm long, often reduced to conidiogenous cells, hyaline, smooth-walled, invested in mucus. Conidiogenous cells phialides, ampulliform to lageniform or cylindrical to subcylindrical, hyaline, thin- and smooth-walled, 6-15 X 2-3.5 ($\bar{x}$ = 11 X 2.7) μm , with up to 3 percurrent proliferations. Conidia blastic-phialidic, fusiform, straight or slightly bent, 4-septate, versicoloured, smooth, 19-27.5 X 6-8.5 ($\bar{x}$ = 23 X 7) μm , bearing appendages (conidium length does not include appendage lengths); basal cell obconic with a truncate base, subhyaline, 3-4.5 ($\bar{x}$ = 3.7) μm long; median cells 3, each subcylindrical or doliiform, together 13-19 ($\bar{x}$ = 16) μm long (supra-basal cell subhyaline to pale brown, central cell dark brown, subapical cell brown); apical cell conic, hyaline, (2.5-) 3-4 ($\bar{x}$ = 3.5) μm long, extending into an irregularly branched, tubular, apical appendage; appendage branches usually 2 or 3, occasionally 5, irregularly spaced, in

an apical crest, often with slightly spatulate tips, flexuous, 10-22 ($\bar{x}$ = 15.5) μ m long; basal appendage lacking, or when present single, unbranched, centric, 1.5-3 ($\bar{x}$ = 2.2) μ m long; mean conidium length/width ratio = 3.7:1.

On living leaves of Camellia japonica, Graft, Salms Gdns., Prague, Winter 1838, Corda (Holotype in PR 155665).

The type specimen comprises four leaves bearing leaf spots 1.5-2 cm diam, oval to irregular in shape, ash gray on the upper surface with narrow, dark or reddish brown margins.

Guba (1961) included many other binomials in the synonymy of P. guepinii. I cannot at present judge whether such synonymy is justifiable or not. Nevertheless, in view of the synonymy proposed above, the binomial P. maculans now is the correct name for P. guepinii, the type species of the anamorph-genus Pestalotiopsis.

Acknowledgments

I thank the curators at BPI and PR for the loan of the specimens in their keeping study. I am deeply indebted to Prof. B. Kendrick, Department of Biology, University of Waterloo, and Dr. Amy Rossman, Mycology Laboratory, Beltsville, Md., U.S.A. for critical reviews of this manuscript. The Natural Sciences and Engineering Research Council of Canada gave financial support for this research in the form of an operating grant to Prof. Kendrick.

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MYCOTAXON

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REDISPOSALS AND REDESCRIPTIONS IN
THE MONOCHAETIA-SEIRIDIUM,
PESTALOTIA-PESTALOTIOPSIS
COMPLEXES. II.
PESTALOTIOPSIS BESSEYII (GUBA) COMB. NOV.
AND PESTALOSPHERIA VARIA SP. NOV.

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A new combination in Pestalotiopsis is proposed for Pestalotia besseyii Guba. An associated teleomorph is described as a new species of Pestalosphaeria.

Supporting Steyaert's (1949) decision to limit Pestalotia to a single species and to redispense most of the other species in Pestalotiopsis and Truncatella, Sutton (1969) stated: "The tendency in recent taxonomic studies is to treat the number of septa as a character subordinate in importance to developmental features of conidia and conidiophores... Variability in number of conidium septa is an accepted feature of most of the Fungi Imperfecti but a few genera do display constancy in septation and it is in the latter group that Pestalotia and its segregates belong. In P. pezizoides, Labridella and Seiridium the conidia are constantly 5-septate. In contrast, the conidia of Pestalotiopsis, Truncatella and Monochaetia are constantly 4-, 3- and 4-septate respectively."

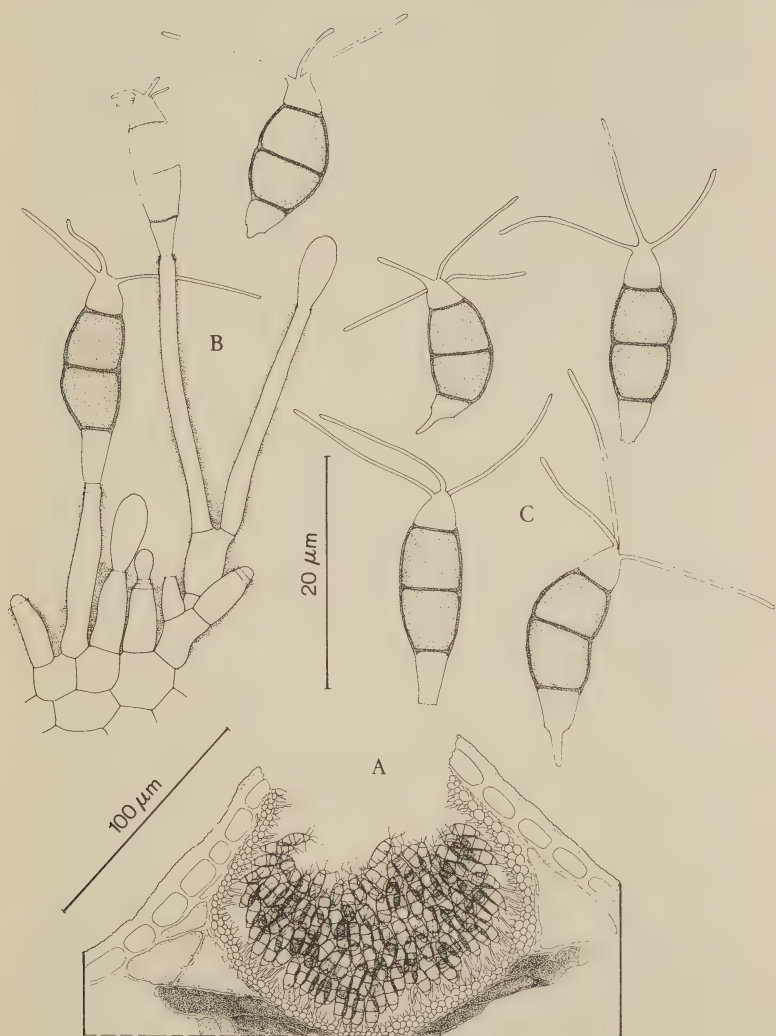


Figure 1. *Pestalotiopsis besseyii* ex type in BPl. A. Vertical section of conidioma. B. Conidiophores. C. Mature conidia.

While I concur with the intent of this statement for the most part, I cannot agree that the number of conidial septa in species of Pestalotiopsis and Monochaetia remain constant at four. I know of an unpublished species of Monochaetia and a species of Seiridium with 3-septate conidia. In several species disposed by Guba (1961) under Pestalotia in the section Quadriloculatae, the anatomical and developmental features conform to those observed in Pestalotiopsis spp. There seems to be little justification for limiting Pestalotiopsis to species with 4-septate conidia. This paper deals with Pestalotia besseyii Guba. Accounts of the other species with 3-septate conidia will be published subsequently in this series.

2. Pestalotia besseyii Guba

Monograph of Monochaetia and Pestalotia, p. 77,
1961.

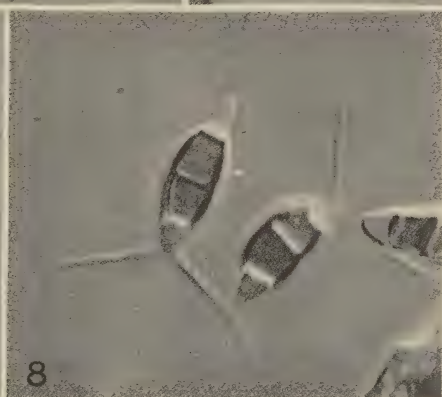
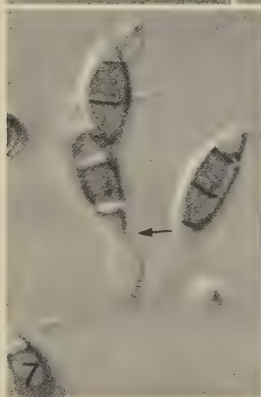
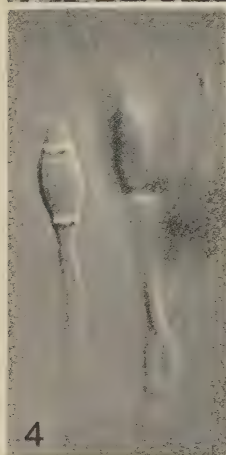
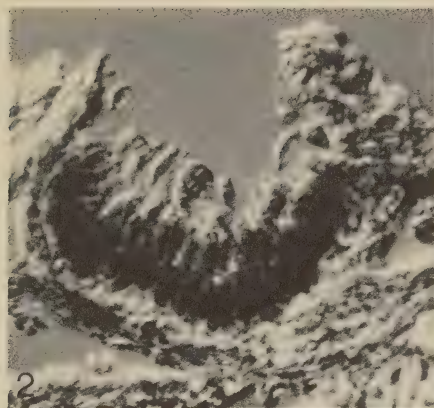
The holotype specimen consists of a few pods of Acacia koa bearing scanty material of the anamorph. Although most of the conidiomata are effete, some have remained in good condition, and the fungus is described in detail and illustrated in Figures 1-8 below.

Pestalotiopsis besseyii (Guba) comb. nov.

≡ Pestalotia besseyii Guba, Monograph
of Monochaetia and Pestalotia, p.
77, 1961.

Fructicolous. Conidiomata stromatic, pycnidoid, scattered to gregarious, erumpent, subperidermal in origin, globose to depressed globose or hemispherical in sectional view, 100-250 μ m diam, 70-200 μ m deep, unilocular, glabrous, dark brown to

Figures 2-8. Pestalotiopsis besseyii ex type in BPI (All with Nomarski interference phase contrast). Fig. 2. Vertical section of conidioma. ca X 230. Figs. 3-7. Conidiophores and conidiogenous cells (arrows in Figs. 5-7 show percurrently proliferating phialides). ca X 1450. Fig. 8. Mature conidia. ca X 1450.



black, dehiscing by a split in the apical wall; basal stroma and lateral wall 10-15 μm thick, of hyaline 'textura globulosa', 2-3 cells thick. Conidiophores arising from the innermost layer of cells of the wall and basal stroma, lining the cavity of the conidioma, sparsely septate and branched only at the base, often reduced to conidiogenous cells, hyaline, smooth, up to 40 μm long, invested in mucus. Conidiogenous cells phialides with minute periclinal thickenings in the collarete zone, lageniform (5-7 X 2-3 μm) or terete to cylindrical (10-23 X 1.5-2.5 μm), hyaline, smooth, proliferating percurrently up to 3 times. Conidia blastic-phialidic, fusiform, 3-septate, 15-19 X 5-6(-6.5) ($\bar{x}$ = 17.3 X 5.5) μm , bearing appendages; basal cell narrowly obconic with a truncate base bearing minute marginal frills, hyaline, smooth, 3-5 ($\bar{x}$ = 4) μm long; median cells 2, doliiform, wall thick, minutely verruculose and with or without slight constrictions at the septa, concolourous and pale brown, together 9-11 ($\bar{x}$ = 10.3) μm long (suprabasal cell 4-5.5 ($\bar{x}$ = 5) μm long; subapical cell 4.5-5.5 ($\bar{x}$ = 5) μm long); apical cell conic with a broad, rounded apex, hyaline, smooth, 3-3.5(-4) ($\bar{x}$ = 3.2) μm long; appendages tubular, unbranched; apical appendages 3, occasionally 2 or 4, inserted at different loci but in a crest at the apex of the apical cell, flexuous, 10-15 (-17) ($\bar{x}$ = 12.3) μm long; basal appendage often lacking, but when present centric, coarse, attenuated, up to 3 μm long; mean conidium body length/width ratio = 3.1:1.

On dry pods of Acacia koa, Kolekole Pass, Oahu, Hawaii, 1.IV.1940, E.A.Bessey (Holotype in BPI).

The type specimen of P. besseyii also bears ascomata of a teleomorph that belongs in the Amphisphaeriaceae. Some of the ascomata are effete, but the description given below and the illustration in Figs. 9-14 have been derived from a study of other ascomata that are in relatively good condition. The morphology of the teleomorph indicates that it belongs in the genus Pestalotia Barr (1975). It appears

to be distinct from all four species currently accepted in Pestalosphaeria (see Table 1).

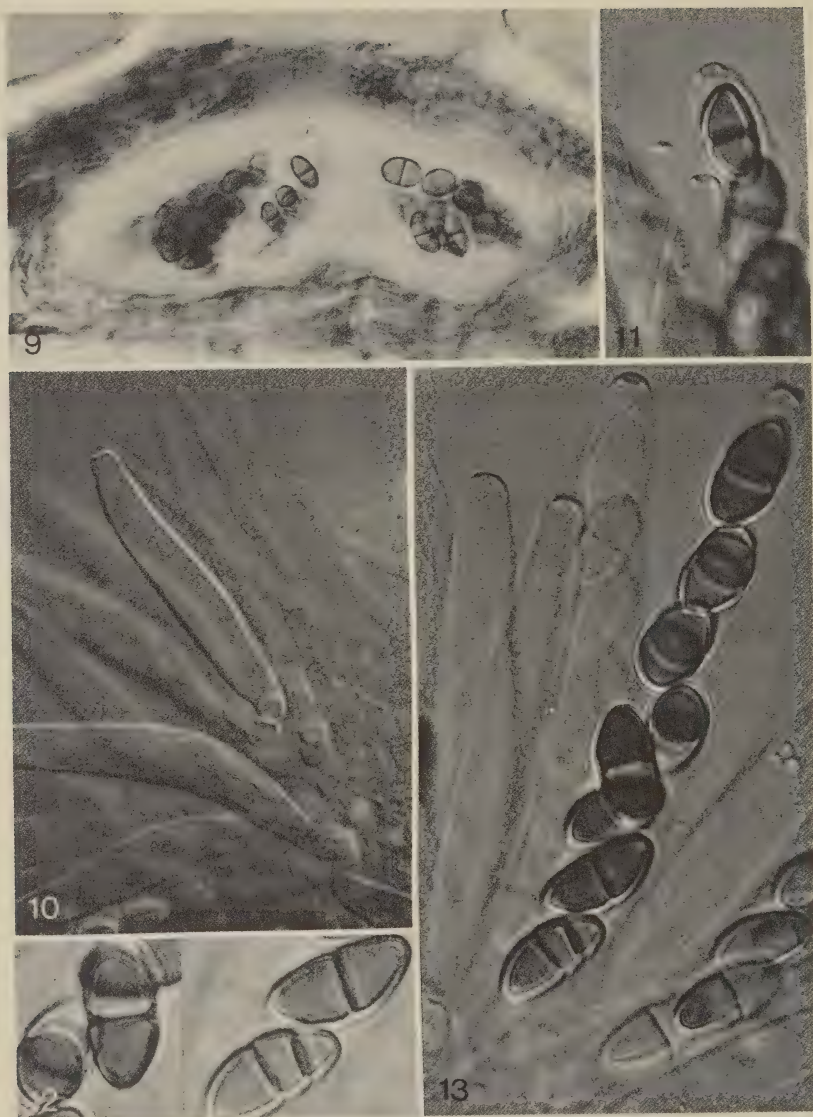
Key to species of Pestalosphaeria

(Note: In some instances, this key emphasizes the features of the anamorph).

1. Ascospores smooth.....2
1. Ascospores verruculose.....4
 2. Ascospores 7-10 μm wide; six conspicuous wall ridges present; central cell heavily pigmented compared to end cells.....P. concentrica
 2. Ascospores 4.5-6 μm wide.....3
3. Ascospores lacking wall ridges, 13-14.5 μm long; versicoloured conidia 21.5-27.5(-30) X 4.5-6 μm , central cell dark brown, adjoining cells brown, apical appendages 2-4, filiform, 9-17 μm long.....P. hansenii
3. Ascospores 12-21 μm long; conidia (23-)27-34 X 6-7(-10) μm , 3 median cells concolourous, olivaceous brown, apical appendages 2-3, with spatulate tips, 19-24 μm long.....P. elaeidis
4. Ascospores versicoloured, 20-23 X 8.5-10 μm , central cell amber brown, end cells grayish brown.....P. austroamericana
4. Ascospores 10-17 X 6-8 μm , concolourous and pale brown to brown.....P. varia

Pestalosphaeria varia sp. nov.

Fruticicola. Ascomata dissita ad gregaria, immersa, depresso globosa cum una leniter papillato collulis, 150-250 μm diam, 70-130 μm alt, unilocularia, glabra, ostiolata, pallide brunnea, in aream ostiolum



Figures 9-13. *Pestalotia varia* ex type in BPI (All with Nomarski interference phase contrast). Fig. 9. Vertical section of an ascoma. ca X 570. Fig. 10. Immature asci and paraphyses. ca X 720. Fig. 11. Ascus tip showing apical apparatus. ca X 720. Fig. 12. Mature ascospores with 1 to 2 septa (verrucosities on the wall can be seen in some ascospores). ca X 1450. Fig. 13. Asci. ca X 1130.

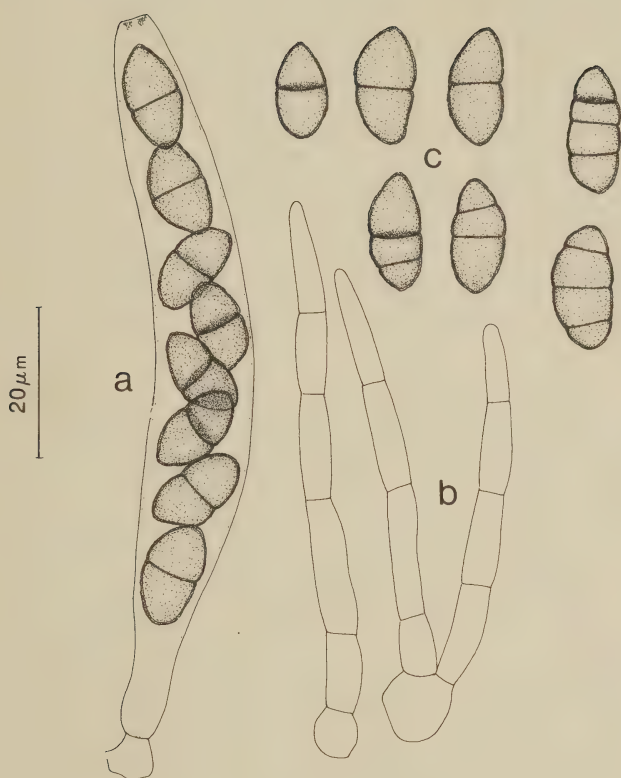


Figure 14. *Pestalosphaeria varia* ex type in BPI.
a. Ascus. b. Paraphyses. c. Mature ascospores.

brunneam; pariete 20-30 μm cr, externe e 'textura angularis' ex cellulis crassitunicatis et pallide brunneis et interne e 'textura prismatica' ex cellulis tenuitunicatis et hyalinis compositus; canalis apicalis periphysatis; ostiolum circulare vel ovale, 20-25 μm diam. Asci unitunicati, clavati cum uno stipite breve, annulus apicalis amyloideus, octospori, 80-95 X 10-12 ($\bar{x}$ = 87 X 11) μm , paraphysibus simplicibus vel irregulatim ramosis, parce septatis, hyalinis, laevis, 50-67 X 5-6 μm interpositi. Ascosporae uniseriatae, fusiformes vel ellipsoideae, transverse circulares,

Table 1. Comparison of ascospore features of *Pestalotia* spp.

Taxon	Dimensions	Septa	End view	Ridges	Ornamentation
<u><i>hansenii</i></u>	13-14.5 X 4.5-6 μ m	2	hexagonal	-	smooth
<u><i>concentrica</i></u>	13.5-20 X 7-10 μ m	2	hexagonal	+	smooth
<u><i>elaeidis</i></u>	12-21 X 4.5-6 μ m	2	NA	NA	smooth
<u><i>austro- americana</i></u>	20-23 X 8.5-10 μ m	2(-3)	NA	-	verruculose
<u><i>varia</i> sp. nov.</u>	10-17 X 6-8 μ m	1(-3)	not hexagonal	-	verruculose

Explanation:

+ = present; - = absent; NA = data not available

vulgo uniseptatae, plerumque 2-3-septatae, pallide brunneae ad brunneae, pariete crasso, verruculoso et in septo leniter contracto, 10-17 X 6-8 ($\bar{x}$ = 14 X 7) μ m; ratione ascosporii long./lat. = 2:1.

Ascomata scattered to gregarious, immersed in the host periderm, depressed globose with a slightly papillate neck, 150-250 μ m diam, 70-130 μ m deep, unilocular, glabrous, ostiolate, pale brown, but brown in the ostiolar region; wall 20-30 μ m thick, composed of an outer 'textura angularis' several cells deep with the cells thick-walled and pale brown, and an inner 'textura prismatica' with thin-walled, hyaline cells; apical canal periphysate; ostiole circular or oval, 20-25 μ m diam. Asci unitunicate, clavate with a short stipe, apical apparatus with an amyloid ring, octosporous,

80-95 X 10-12 ($\bar{x}$ = 87 X 11) μm , intermixed with sparsely septate, simple or irregularly branched, hyaline, smooth-walled paraphyses 50-67 μm long and 5-6 μm wide. Ascospores uniseriate, fusiform to ellipsoid with somewhat rounded ends, transversely circular, mostly 1-septate, occasionally 2-3-septate, pale brown to brown, wall relatively thick, verruculose and occasionally constricted at the septa, 10-17 X 6-8 ($\bar{x}$ = 14 X 7) μm ; mean ascospore length/width ratio = 2:1.

On dry pods of Acacia koa, Kolekole Pass, Oahu, Hawaii, 1.IV.1940, E.A. Bessey (Holotype in BPI).

The association of Pestalosphaeria varia and Pestalotiopsis besseyii on the same specimen is extremely significant in view of earlier reports of genetic connections between teleomorphs in Pestalosphaeria and anamorphs in Pestalotiopsis. Barr (1975) established that there was a genetic connection between Pestalosphaeria concentrica Barr and Pestalotiopsis guepinii (Desm.) Stey. var. macrotricha (Kleb.) Sutton, when single ascospore isolations yielded cultures of the anamorph. The teleomorph failed to form in these cultures. Shoemaker & Simpson (1981) reported similar events with single ascospore isolates of Pestalosphaeria hansenii Shoemaker & Simpson, which produced an undetermined species of Pestalotiopsis. Booth & Robertson (1961) reported that both anamorph and teleomorph developed in single ascospore cultures of Pestalosphaeria elaeidis (Booth & Robertson) Van der Aa ($\equiv$ Leptosphaeria elaeidis Booth & Robertson). Nag Raj (1979) reported a presumptive connection between Pestalosphaeria austroamericana Nag Raj & DiCosmo and an unnamed species of Pestalotiopsis by virtue of the close association between the two on the same specimen; cultural studies were not feasible. In view of this overwhelming evidence it is tempting to suggest a genetic connection between Pestalosphaeria varia and Pestalotiopsis besseyii. However, such a suggestion needs to be confirmed by cultural studies from fresh

collections of the teleomorph and anamorph from the type locality. The conidial features of the anamorphs of *Pestalospheeria* spp. and *Pestalotiopsis besseyii* are compared in Table 2.

Table 2. Comparison of conidial features of *Pestalotiopsis besseyii* and anamorphs of *Pestalospheeria* spp.

Features	<u>hansenii</u>	<u>concentrica</u>	<u>elaeidis</u>	<u>austro-</u> <u>americana</u>	<u>besseyii</u>
Dimensions in μm	21.5-27.5 (-30)X 4.5-6	20-32 X 6-8	(23)-27-34 X 6-7(-10)	28-30 X 10-11	15-19 X 5-6 (-6.5)
Number of septa	4	4	4	4	3
median cells	central dk. br., adj.br.	two upper darker br.	conc. oliv. br.	central dk. br., adj. br.	conc. pale br.
apical appendage- number	2-4	2-4	2-3	2-5	2-4
form & length	filif.	filif.	spath.	filif.	filif.
in μm .	9-17	(5-)12-38	19-24	12-40	10-15 (-17)
basal appendage length (μm)	5-7	10-18	5-7	4-10	0-3

Explanation:

dk. = dark; br. = brown; adj. = adjacent cells; conc. = concolourous;
oliv. = olivaceous; filif. = filiform; spath. = spathulate.

Acknowledgments

I thank the curator at BPI for the loan of the specimen examined in this study. I am deeply indebted to Prof. B. Kendrick, Department of Biology, University of Waterloo, and Dr. Amy

Rossman, Mycology Laboratory, Beltsville, Md., U.S.A. for critical reviews of this manuscript. The Natural Sciences and Engineering Research Council of Canada gave financial support for this research in the form of an operating grant to Prof. Kendrick.

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REDISPOSALS AND REDESCRIPTIONS IN THE
**MONOCHAETIA-SEIRIDIUM,
 PESTALOTIA-PESTALOTIOPSIS**
 COMPLEXES. III.
MONOCHAETIA ILICINA (SACC.) COMB. NOV.

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A new combination is proposed
 for Pestalotia ilicina Sacc.

3. *Pestalotia ilicina* Sacc.
 Nuova Gior. Bot. ital. 8: 198, 1876.

Saccardo (1876) published an account of this fungus and distributed exsiccati as *Mycotheca Veneta* No. 327. The label on the packet of exsiccatum indicates that Saccardo had some suspicion that his fungus was the same as *Pestalotia ilicis* Westd. (Bull. Ac. Roy. Belg. 7: 90, 1859). Later, Saccardo (1884) redispersed the fungus in *Cryptostictis* as *C. ilicina*. Guba (1961), however, included *Pestalotia ilicina* as a synonym of *Monochaetia monochaeta* (Desm.) Allesch. *Pestalotia ilicis*, a binomial accepted by Guba, had earlier been correctly disposed by Steyaert (1949) as *Pestalotiopsis ilicis* (Westd.) Stey.

A study of the exsiccatum in BPI indicates that the fungus belongs in *Monochaetia* (Sacc.) Allesch. Guba (1961) was in error when he included

Table 1. Comparison of conidial features of Monochaetia ilicina, M. monochaeta, M. mucronata, and M. saccardiana.

Features	<u>ilicina</u>	<u>monochaeta</u>	<u>mucronata</u> (Sutton 1975)	<u>saccardiana</u> (Guba 1961)
Dimensions in μm	15-22 X 5.5-7.5	15-28 X 4.5-6.5	16-20 X 6.5-7.5	12-16 X 4-5
number of septa	3-4	4	3-4	3
med. cells - tot. length in μm	10-14/ 9-12.5	10-18.5	10-13.5	8-11
wall orn.	smooth	minutely verruc.	smooth	NA
pigmntn.	pale br.	pale oliv.	brown	pale oliv.
appendage length in μm				
apical	up to 4.5	6-24	1-2	3-7 (-10)
basal	up to 1	up to 15	1	6-10
l/w ratio	2.8:1	3.5:1	* 2.6:1	* 3.1:1

Explanation:

med. cells = median cells; tot. length = total length;
orn. = ornamentation; verruc. = verruculose; pigmntn. = pigmentation;
br. = brown; oliv. = olivaceous; NA = data not available.

* estimated value based on reported conidial dimensions (vide Guba 1961 and Sutton 1975).

Pestalotia ilicina as a synonym of Monochaetia monochaeta (Desm.) Allesch. The features of P. ilicina suggest that the fungus is identical with Monochaetia mucronata (Massal.) Maire. From a study of the holotype specimen of Coryneum mucronatum Massal. (on leaves of Quercus pubescens, Scaveaghe, Verona, Italy, II.1890, C. Massalongo) in VER, Sutton (1975)

concluded that Guba (1961) erred in placing M. mucronata in synonymy with M. saccardiana (Vogl.) Sacc. Guba (1961) attributes to M. saccardiana conidial dimensions that are different from those reported by Sutton for M. mucronatum and from those obtained for P. ilicina in the present study. Nevertheless, Sutton subsequently (1980) accepted the synonyms published by Guba (1961) for M. saccardiana. I disagree. Pestalotia ilicina and M. mucronata are identical. Table 1 clearly shows the differences between M. ilicina, M. monochaeta and M. saccardiana, in conidial length/width ratio, ornamentation of median cell walls, and the length of the apical appendage. The epithet 'ilicina' has priority over the epithet 'mucronatum'. Hence, the correct nomenclator for the fungus under consideration should be:

Monochaetia ilicina (Sacc.) **comb. nov.** Figs. 1-7
 ≡ Pestalotia ilicina Sacc., Nuova
 Gior. Bot. ital. 8: 198, 1876.
 ≡ Cryptostictis ilicina (Sacc.)
 Sacc., Syll. Fung. 3: 443,
 1884; Syll. Fung. 15: 242,
 1901.
 = Coryneum mucronatum Massal.,
 Malpighia 8: 208, 1894.
 ≡ Monochaetia mucronata (Massal.)
 Maire, Bull. Soc. Bot. Fr. 53:
 187, 1907.

Follicolous. Conidiomata stromatic, acervuloid, predominantly eliphyllous, scattered to gregarious, orbicular to oval or irregular in outline, 150-190 μm wide, 80-100 μm deep, intraepidermal in origin, erumpent, unilocular, glabrous, dark brown to black, dehiscing by a stellate split in the overlying host tissue; basal stroma 15-30 μm thick, of 'textura globulosa', cells moderately thick-walled, subhyaline to pale brown. Conidiophores lining the cavity of the conidioma, arising from the upper layer of cells of the

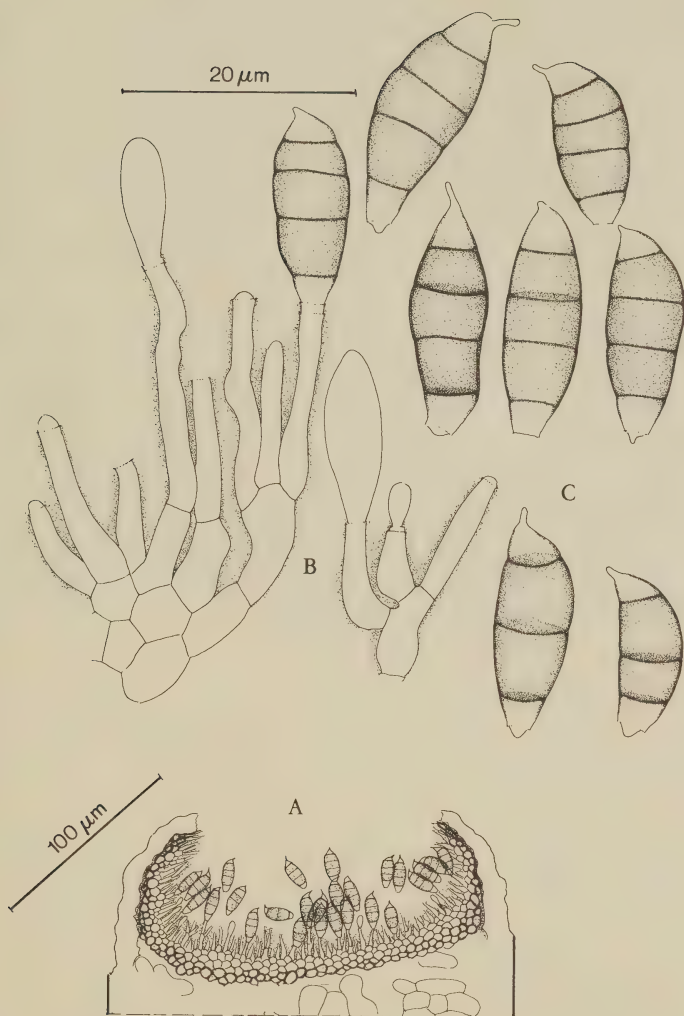
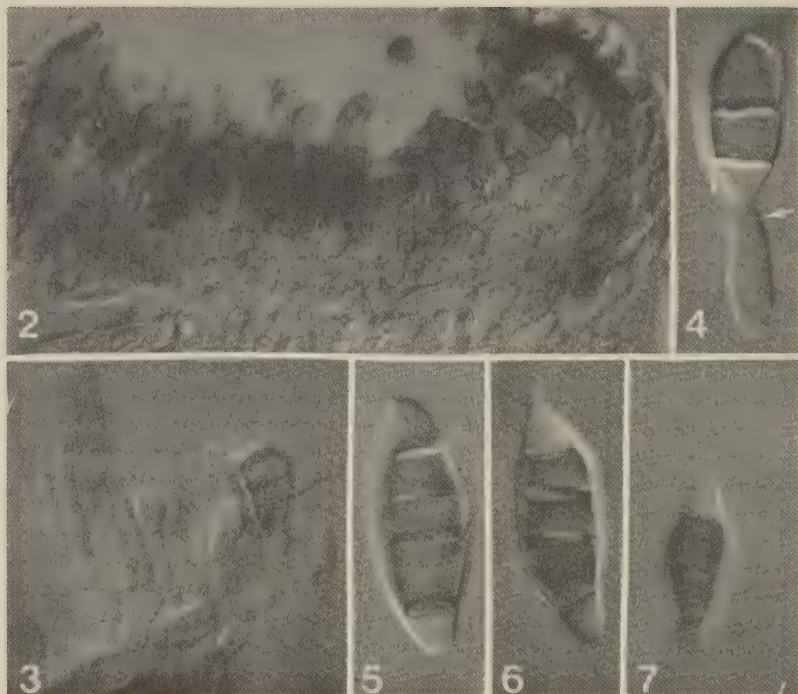


Figure 1. *Monochaetia ilicina* ex isotype in BPI (Saccardo--Mycoth. Ven. No. 327). A. Vertical section of conidioma. B. Conidiophores with conidiogenous cells. C. Mature conidia.

basal stroma, septate and irregularly branched, hyaline, smooth-walled, invested in mucus, up to 40



Figures 2-7. *Monochaetia ilicina* ex isotype in BPI (All with Nomarski interference phase contrast). Fig. 2. Vertical section of a conidioma. X 480. Figs. 3 & 4. Conidiogenous cell and conidiophores. Arrow in fig. 4 marks the annellations. Fig. 3-- X 1250; Fig. 4. X 2000. Figs. 5-7. 4-septate and 3-septate mature conidia. Figs. 5, 6-- X 2000; Fig. 7-- X 1250.

.....
 um long. Conidiogenous cells annellides, terete, lageniform or irregular, hyaline, smooth-walled, 8-23 X 2-3.5 ($\bar{x}$ = 15.5 X 2.7) μ m, with up to 3 annellations. Conidia blastic-annellidic, ellipsoid to fusiform, 3-4-septate, 15-22 X 5.5-7.5 ($\bar{x}$ = 18.5 X 6.5) μ m, often bearing apical and occasionally basal appendages; basal cell obconic with a truncate base, subhyaline to hyaline, smooth-walled, 2.5-4 ($\bar{x}$ = 3.2) μ m long; 3 or 2 median cells doliiform, pale brown, wall smooth and often slightly constricted at the septa, together 10-14 ($\bar{x}$ = 12) μ m long in 4-septate forms, but 9-12.5 ($\bar{x}$ = 10.5) μ m long in 3-septate forms (suprabasal cell 4-6 (-6.5) ($\bar{x}$ = 5) μ m long; central and

subapical cells 3-4 ($\bar{x}$ = 3.5) μm long); apical cell conical with a mucronate apex or the apex drawn out into an appendage, subhyaline to hyaline, smooth-walled, 2-4.5 ($\bar{x}$ = 3.2) μm long; apical appendage, when present, tubular, attenuated, oblique, 1-2 ($\bar{x}$ = 1.5) μm long; basal appendage often lacking, but when present centric, tubular, attenuated, up to 1 μm long; mean conidium length/width ratio = 2.8:1.

On leaves of Quercus ilex, Arco, Trentino, N. Italy, IX.1874 (isotype in BPI).

I have not examined the type specimen of Monochaetia saccardiana. If subsequent studies reveal that it is identical with M. ilicina, it will have to be considered a synonym of the latter, since P. ilicina predates Pestalotia saccardiana Vogl. (Atti. Soc. Ven.-Trent. Sci. Nat. Padova 9: 233, 1885).

Acknowledgments

I thank the curator at BPI for the loan of the specimen examined in this study. I am deeply indebted to Prof. B. Kendrick, Department of Biology, University of Waterloo, and Dr. Amy Rossman, Mycology Laboratory, Beltsville, Md., U.S.A. for critical reviews of this manuscript. The Natural Sciences and Engineering Research Council of Canada gave financial support for this research in the form of an operating grant to Prof. Kendrick.

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January-March 1985

REDISPOSALS AND REDESCRIPTIONS IN THE **MONOCHAETIA-SEIRIDIUM**, **PESTALOTIA-PESTALOTIOPSIS** COMPLEXES. IV. ON MONOCHAETIA MIERSI

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Waterloo, Ontario, Canada. N2L 3G1.

Monochaetia miersi Speg. is shown
to be a species of Pestalotiopsis.

4. Monochaetia miersi Speg.

Bol. Acad. Nac. Ci. Cordoba (Argent.) 25:113,
1921.

On rind of fruits of Bellota miersi, in
woods near Los Perales, Chile, Spring 1918, C.
Spegazzini (type in LPS 12046).

Both Steyaert (1961, see also annotation
in Fig. 1c) and Guba (1961) considered Monochaetia
miersi an acceptable taxon. Published descriptions
characterize the fungus as bearing numerous,
somewhat lenticular, brownish black to black,
innate-erumpent acervuli 200-350 μ m diam.; fusiform
or clavate fusiform, 5-celled conidia, 30-35 X 7-10 μ m;
with 3, pellucid, dark coloured intermediate cells equal
in size; basal cell elongate-turbinate, hyaline,
tapering; apical cell short conoid, abruptly
terminating in a short, somewhat lateral or oblique

UNIVERSIDAD NACIONAL DE LA CIUDAD EVA PERON
MUSEO - INSTITUTO SPEGAZZINI
COLECCIONES MICOLÓGICAS

No. 12046. TIPO

Monochaetia miersii Speg.
S/. *Bullota miersii*

Chile, Los Perales, 1918.
Leg. C. Spezzazzini

(Inst. Speg. C. M. 12046)

Monochaetia miersii Speg.
25. V. 1960
R. P. Krieger

Determinavit

Monochaetia miersii Speg. (n. form.) + *Bullota miersii* Speg.
Los Perales
1918

287
SC-12

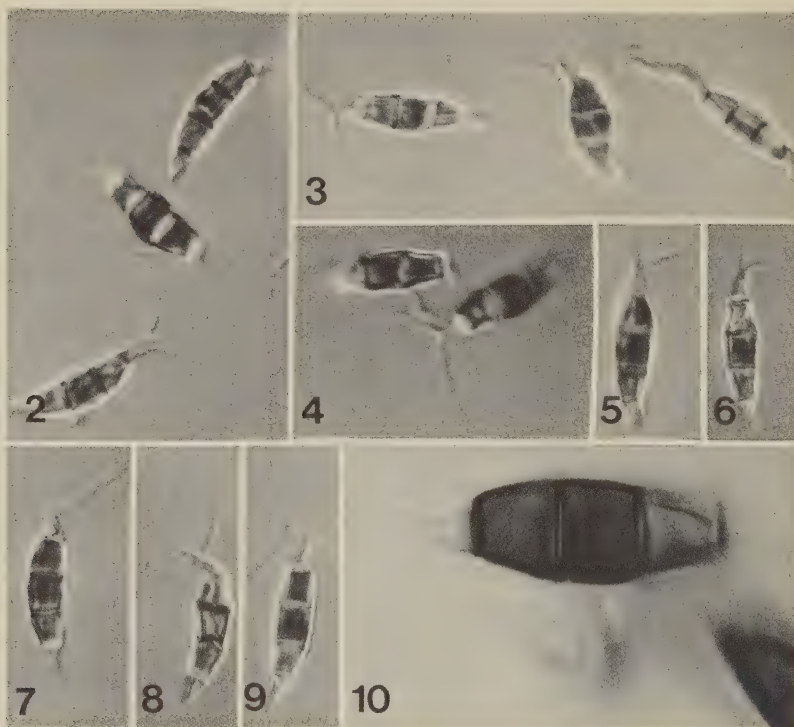
Figure 1. Pestalotiopsis sp. ex type of Monochaetia miersi in LPS. Copy of the label (a), Spegazzini's pencilled notation (b), and Steyaert's annotation concerning the fungus (c).

setula, 8-10 X 1 μm , and a short and delicate 'pedicel'.

I have examined the type specimen. The label on the herbarium packet along with Spegazzini's pencilled notes and Steyaert's annotation pertaining to the fungus are reproduced in Fig 1a-c. The packet contains numerous fragments of fruit rind of the host bearing abundant conidiomata, which are scattered to gregarious, innate erumpent, appearing initially as minute yellowish brown blisters, ultimately dehiscing to reveal a black mass of agglutinated conidia. Several problems were encountered while studying anatomical details of the fungus. In the numerous sections examined, the conidiomata appear stromatic and pycnidoid, but details of the basal stroma or lateral wall and of the conidial hymenium could not be elucidated since these structures had collapsed and/or disintegrated. Repeated attempts at rehydration of the material in water and 2% KOH, prior to sectioning, did not improve the results. The conidia tend to cohere and can be separated only with great difficulty. Results obtained from several squash mounts are illustrated in Figs. 2-10.

The apical and basal cells in a majority of the conidia have collapsed, and remnants of these present the appearance of conidial appendages. As a result, it was impossible to obtain reliable dimensions for entire conidia. The three median cells are short cylindric to doliiform, brown but versicoloured, with the two upper cells darker than the lower cell; smooth-walled, measuring 17-21 μm long in toto (individual cells 5-6 ($\bar{x}$ = 5.5) μm , 6-7.5 (-8) ($\bar{x}$ = 6.7) μm , and 6.5-7.5 ($\bar{x}$ = 7) μm long), 7.5-9 μm wide. In a few intact conidia the basal cell appears obconic with a truncate base, hyaline, thin- and smooth-walled, 3-5 μm long, often bearing an unbranched, centric, tubular appendage up to 7 μm long; the apical cell is conical, hyaline, thin- and smooth-walled, 4-5 μm long, with 3-4 tubular appendages 3-9(-20) μm long.

The fact that Spegazzini, astute mycologist



Figures. 2-10. Conidia of Pestalotiopsis sp. ex type of Monochaetia miersi in LPS (All with Nomarski interference phase contrast). Figs. 2-9. X 800. Fig. 10. X 2000.

that he was, included only 3 conidia and no sectional views of the conidioma in his pencilled notes (although he included sectional views with many other of his coelomycete collections), and the fact that tissues of the wall and conidial hymenium are mostly disintegrated in the collection suggest that the specimen was in all probability not in good condition even at the time of collection. Spegazzini's sketch of one of the conidia with apically knobbed and trifid apical cell (middle conidium in Fig 1b) appears significant in relation to my findings. Although Spegazzini did not record multiple apical appendages on the conidia, these are clearly visible in Figs. 2-9.

The versicoloured median cells, presence of 3-4 tubular appendages at the apex of the apical cell, and the presence of an occasional centric, tubular appendage on the basal cell are not characteristic for species of Monochaetia but are typical of species of Pestalotiopsis. The difficulty in elucidating qualitative and quantitative characters satisfactorily due to the condition of the specimen, presents an obstacle for determination of the species affinities. Hence, M. miersi has to be considered a species of Pestalotiopsis of uncertain status in the genus.

Acknowledgments

I thank the curator at LPS for the loan of the specimen examined in this study. I am deeply indebted to Prof. B. Kendrick, Department of Biology, University of Waterloo, and Dr. Amy Rossman, Mycology Laboratory, Beltsville, Md., U.S.A. for critical reviews of this manuscript. The Natural Sciences and Engineering Research Council of Canada gave financial support for this research in the form of an operating grant to Prof. Kendrick.

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NOTICES

ASPT HERBARIUM TRAVEL AWARDS

The American Society of Plant Taxonomists is pleased to announce the availability of competitive awards for travel by graduate students to the nation's herbaria. Awards will not exceed \$500 and will be used to help to pay expenses to and from any herbarium (or herbaria) in the United States and per diem expenses during the visit. The first competition deadline was 1 January 1985, with a second deadline 1 July 1985. The grants program will last a minimum of three years (six competitions). Interested Master's or Ph.D. graduate students should send a curriculum vitae, two letters of recommendation (including one from the major professor), a two or three page outline of the proposed research emphasizing the role that the visit to the herbarium will play, and a letter from the Head Curator, Chairman or Director of the institution(s) to be visited indicating willingness to receive the visitor. Completed applications and additional questions should be directed to Tod F. Stuessy, Chairman, ASPT Committee for Systematics Collections, Department of Botany, Ohio State University, 1735 Neil Avenue, Columbus, OH 43210. (Telephone: (614) 422-5200 or (614) 422-8952.)

GRADUATE AND POST-GRADUATE RESEARCH GRANTS

The Biological Research Station of the Edmund Niles Huyck Preserve Inc. offers grants for the support of research in which the natural resources of the Huyck Preserve are utilized. These grants in amounts up to \$3500 are available to graduate and post-graduate investigators.

The 1,400 acre Preserve is located on the Helderberg Plateau, in the Town of Rensselaerville, 30 miles southwest of Albany, New York. Included within the Preserve are natural and reforested woodlands, old fields, Lake Myosotis (100 acres), Lincoln Pond (10 acres), and approximately three miles of intermittent streams. Housing and laboratory space are provided here.

Inquire for instructions on application and for additional information from Box 188, Rensselaerville, NY 12147. Applications are due in early January, each year.

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PHYTOPHTHORA CLANDESTINA SP. NOV. IN ROOTS OF SUBTERRANEAN CLOVER

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INTRODUCTION

In 1982 sporangia of a *Phytophthora* species were observed on rotted roots of subterranean clover (18). The plants were sampled from sites in Victoria where root rot is recognised as a serious problem which reduces the productivity of pastures (18,19). The fungus could not be isolated using standard selective media. It was eventually cultured from aseptically produced clover seedlings infected by zoospores (18). The fungus showed a unique combination of sporangial, gametangial and vegetative characters and we describe it here as a new species, *Phytophthora clandestina*.

METHODS

Detection. Roots of subterranean clover plants from sites affected by root rot were washed free of soil and sections of tap roots with lesions were washed vigorously with tap water. The root pieces were transferred to sterile distilled water in Petri-dishes, incubated at 20°C for 24-48h and examined microscopically for sporangia. These were usually most abundant on slightly discoloured tissue near the margins of root lesions. Cortical tissues adjacent to the stele of infected roots usually contained oogonia similar to those of *Phytophthora*. Small pieces of these roots were mounted on slides for detailed observations of gametangial morphology.

Isolation. Subterranean clover seeds cv. Woogenellup were treated with sodium hypochlorite solution (1% active chlorine) under continuous agitation

for 45 min., rinsed twice in sterile water and germinated at 20°C on moist sterile filter paper. Small pieces of naturally-infected roots bearing abundant sporangia were transferred to sterile distilled water in Petri-dishes. Zoospore production was stimulated by chilling the dishes in a refrigerator at 5°C for approx. 30 min. and returning them to 20°C. A few drops of zoospore suspension were transferred to dishes of sterile water containing 2-3-day-old seedlings of subterranean clover. After 4-7 days at 20°C, abundant sporangia were visible on infected seedling baits. Contamination by other micro-organisms was reduced by repeating the production and transfer of zoospores, or by transfer of single sporangia (using a pasteur pipette drawn to a very fine capillary) to fresh seedlings in Petri-dishes. This procedure eliminated *Pythium* spp., which were slower to sporulate and release zoospores than the clover-infecting *Phytophthora*. Infected seedlings were washed in sterile water, blotted dry on sterile filter-paper and placed on agar. Bacterial contamination was eliminated by inverting the agar after 3-4 days and subculturing from the reverse side of the colony (14)

Media. Lima bean agar (LBA) was found to be most suitable for isolation and growth of the fungus. Pea-sucrose agar (3) also supported good growth and sporulation but was too opaque for microscopic examination of colonies. Other media used were water agar (distilled water 1L, "Oxoid" agar no.3, 20g), corn meal agar (distilled water 1L, "Oxoid" Cornmeal agar, 20g) and V8-juice agar (11). LBA was prepared as a homogenate of 300g canned lima beans ("Masterfoods" brand) strained through six layers of cheese cloth and made up to one litre with distilled water. The pH was adjusted to 6.0 and 15g of agar ("Oxoid" no.3) was added before the medium was autoclaved at 101 kPa for 20 min.

Observations and Measurements. Hyphal characters and swellings were measured and described from agar culture. Sporangia formed on clover seedlings in distilled water were mounted in lactic acid or lactic acid-trypan blue for observations of morphology and measurements of papilla depth and pedicel length. Measurements of length and breadth were made in water. Zoospores in distilled water were killed with formaldehyde to facilitate observation and measurement. Oogonia and antheridia were observed in roots mounted in distilled water, lactic acid, or lactic acid-trypan blue. Melzer's reagent (16) was used to stain antheridia within host tissues (Pascoe, unpublished data). Measurements of the diameter of oogonia and oospores were made in lactic acid mountants and were taken at right angles to the axis of the oogonial stalk. Antheridial length was determined as the longest visible axis within delimiting septa and the width was taken at right angles to the length. All dimensions are quoted as the range and mean $\pm$ the standard deviation of 100 measurements, except those which showed little variation.

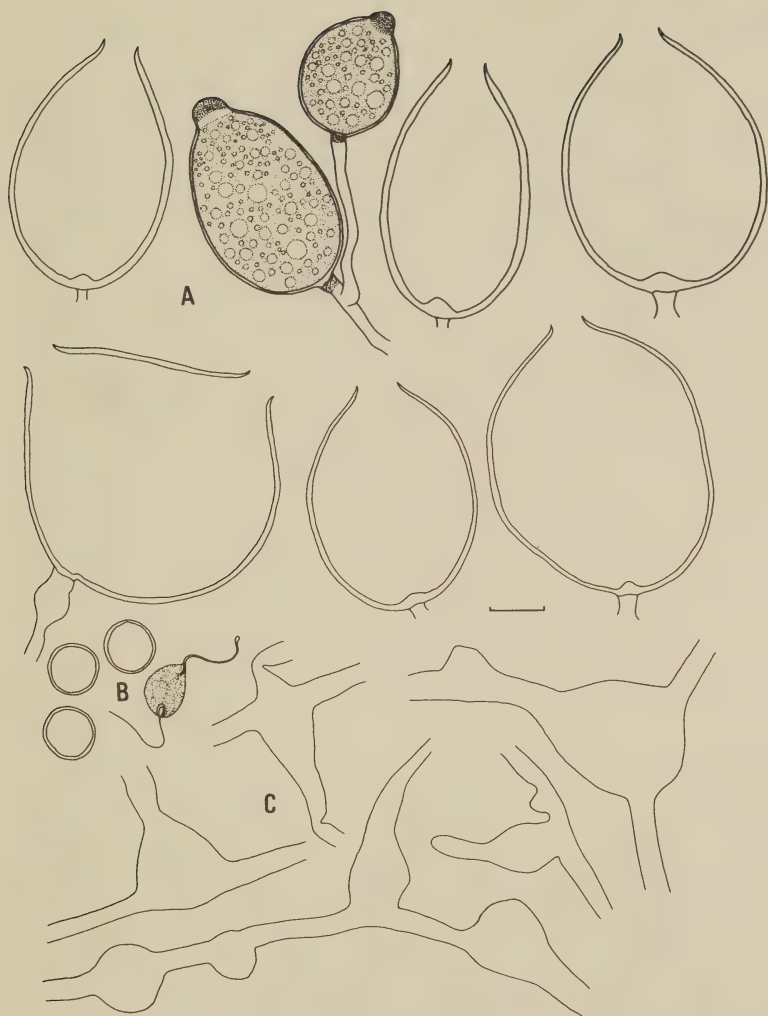


FIG. 1. *Phytophthora clandestina*. A: Sporangia, B: Zoospore and encysted zoospores, C: Hyphal swellings on V8-juice agar. Scale bar represents 10 μ m.

DESCRIPTION

Phytophthora clandestina Taylor, Pascoe and Greenhalgh sp. nov.

Hyphae in agaro lentissime crescentes, hyalinae; hyphae aerae 1.5 - 3.9 μm crassae, hyphae submersae 3.0 - 15.0 μm (medio 6.0 $\pm$ 2.0 m) crassae, ramosae ad angulum c. 90°, rami ad nodos inflati subspherici vel deltoidei, 7.5 - 24 μm (medio 18.4 $\pm$ 4.0 μm) diametro. **Chlamydosporae** ignotae. **Sporangiophora** non ramosa, sympodialia, c.3 μm crassa. **Sporangia** decida, ellipsoidea vel ovoidea, raro subglobosa, 19-66 μm (medio 41 $\pm$ 16 μm) longa, 15-41 μm (medio 32 $\pm$ 11 μm) lata; longi:lata 1.35:1; papillae conspicuae, 5.6 $\pm$ 1.2 μm profundae, c.7 μm latae; obturamenta conspicua umbonata vel conica septo basali; pedicellis basalibus brevissimis. **Zoosporae** flagellis binis lateralibus, limoniformes vel fusiformes, c.12x8 μm , ubi incystatae 10 m diam. globosae. **Oogonia** plerumque terminalia raro intercalaria, 21-36 μm (medio 30 $\pm$ 3 μm) diam.; paries 0.5-1.0 μm crassus, in agar aureus. **Antheridia** terminalia vel subterminalia interdum intercalaria, quoad formam et magnitudinem irregularia, 9-45 μm (medio 18 $\pm$ 5 μm) longa, 4-17 μm (medio 11 $\pm$ 3 μm) lata, processibus digitatis saepe per septum separatis; in radicibus pro maxime parte paragyna, in agar usque ad 50% amphigyna. **Oosporae** valde aploeroticae, 19-30 μm (medio 25 $\pm$ 2 μm) diam., parietibus 0.3-3.6 μm (medio 1.4 $\pm$ 1 μm) crassis. **Crescit** in agar inter 5°C ad 31°C optime ad 25°C. **Hab.** in radicis putridis *Trifolii subterranei*, Kyabram, Victoriae, Australiae, March 1983, coll. P.A. Taylor. Holotypus in VPRI 12234 conservatus, isotypus ad IMI 278933 et DAR 49489.

Phytophthora clandestina Taylor, Pascoe and Greenhalgh.

Colonies on solid media slow-growing, radial growth rate c.1.5-2.0 mm.day⁻¹ on LBA in darkness at 25°C. Aerial mycelium on agar conspicuous and dense. Aerial hyphae slender, 1.5-3.9 μm (mean 2.7 $\pm$ 1.5 μm) thick; submerged hyphae 3-15 μm (mean 6 $\pm$ 2 μm) thick, abundantly branched at approximately right angles. Subspherical to deltoid hyphal swellings occur along the hyphae, frequently at or adjacent to branch points, 8-24 μm (mean 18 $\pm$ 4 μm) in diameter (Figs.1,3.). **Chlamydospores** not observed. **Sporangiophores** c.3 μm thick, with simple, sympodial branching. Nodal swellings rare. **Sporangia** (Figs.1,3.) are produced most abundantly on infected material submerged in water but also occur frequently on solid media. Sporangia papillate, occasionally with two or three papillae, apical thickening c.4-6 μm deep in lactic acid, exit pore c.6-7 μm wide. Sporangia broadly ellipsoid to ovoid, sometimes sub-globose, 19-66 μm (mean 41 $\pm$ 16 μm) long and 15-44 μm (mean 32 $\pm$ 11 μm) wide, length to breadth ratio



FIG. 2. *Phytophthora clandestina*, gametangia in roots of subterranean clover seedlings. A:Oogonia and paragynous antheridia. B:Oogonia and amphigynous antheridia. Scale bar represents 10 μ m.

1.35:1 (range 1.2:1 to 1.4:1). Frequently a conspicuous, dome-shaped or broadly conical basal plug protrudes into the sporangium. Sporangia not readily removed from sporangiophores at first, but empty sporangia deciduous, seceding by a short (1-6 μm) occluded pedicel. **Zoospores** (Fig.1) limoniform to reniform, c.12x8 μm , with two lateral flagellae and, when encysted, globose, c.10 μm diameter. **Gametangia** (Figs 2,3.) abundant in infected host roots, sparse and slow to develop in culture (c.4 weeks at 20°C on LBA). **Oogonia** usually terminal, rarely intercalary (frequency 2%), diameter 21-36 μm (mean $30 \pm 3 \mu\text{m}$), inter- or intracellular, more or less spherical, sometimes distorted or assuming the shape of the host cell. Oogonial wall smooth, 0.5-1.0 μm thick, golden yellow in culture, colourless in host tissue. **Antheridia** paragynous or amphigynous; predominantly paragynous (70-93%) in host tissues, but frequently amphigynous (50-60%) in agar culture. Antheridia terminal or subterminal, occasionally intercalary (frequency 14%), variable in shape and size, 9-45 μm (mean $18 \pm 5 \mu\text{m}$) long, 4-17 μm (mean $11 \pm 3 \mu\text{m}$) wide, delimited by a thick basal septum. Antheridia frequently (35%) complex, often with one or more digitate processes which may be delimited by thick septa. Amphigynous antheridia often eccentric about the oogonial stalk. **Oospores** markedly aplerotic, diameter 19-31 μm (mean $25 \pm 2 \mu\text{m}$), wall 0.3-3.6 μm (mean $1.4 \pm 1.0 \mu\text{m}$) thick.

Optimum temperature for radial growth on agar c.25°C, minimum <5°C, maximum 31°C.

The holotype specimen VPRI 12234 is derived from rotted roots of *Trifolium subterraneum* subsp. *yanninicum* cv. Yarloop from Kyabram, Victoria, Australia. The fungus is preserved in the herbarium of the Plant Research Institute, Burnley, Victoria as microscope slides, dried cultures and infected roots. Isotype specimens are deposited as IMI 278933 and DAR 49489.

Etymology: from Latin, "clandestinus", meaning hidden or secretive, in recognition of the difficulty encountered in detecting and culturing the fungus.

DISCUSSION

Several fungi, in particular *Fusarium* spp. and *Pythium* spp. have been associated with root rot of subterranean clover (1,2,5,8,9,10,15,17), but reports of *Phytophthora* spp. are rare. Stovold (17) isolated a "sterile" *Phytophthora* with non-papillate sporangia (Stovold, personal communication) from rotted roots at one location in New South Wales, Australia (17). In North America, *P. megasperma* Drechs. has been associated with diseased subterranean clover (7,13). Both fungi are clearly distinct from *P. clandestina* (12,20,21).

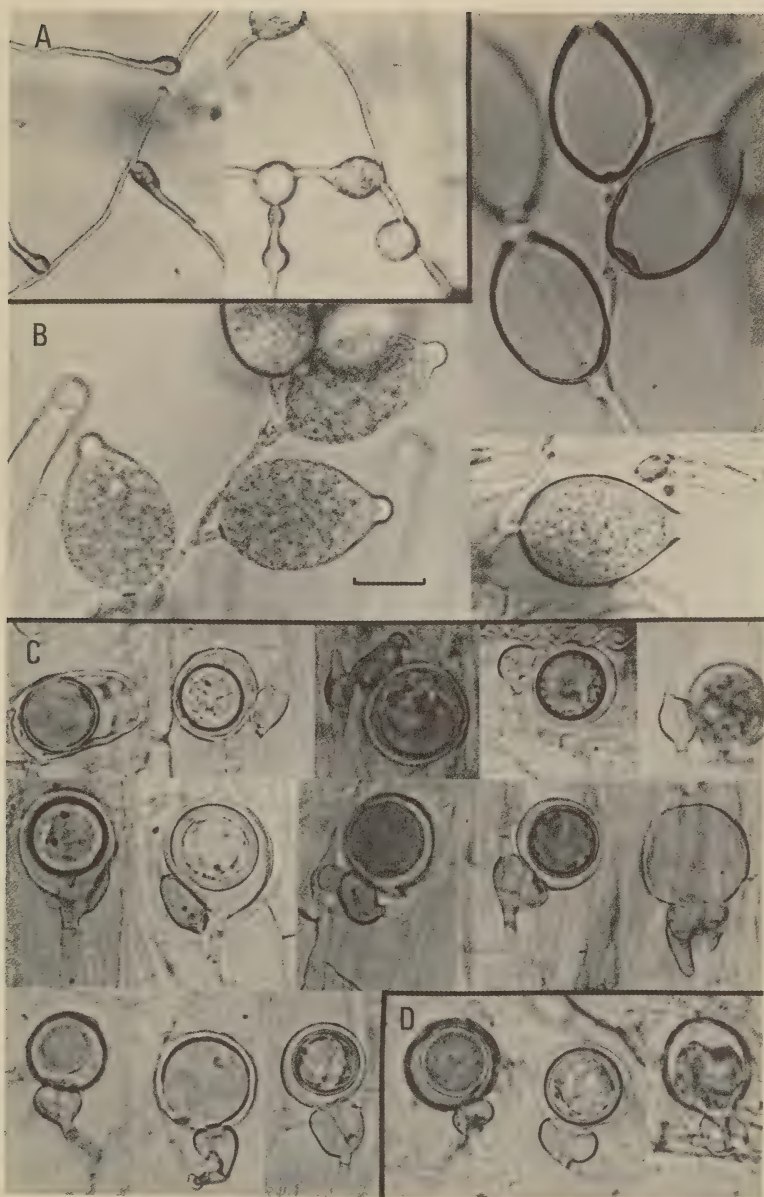


FIG 3. *Phytophthora clandestina*. A:Hyphal swellings. B:Sporangia. C:Gametangia in roots. D:Gametangia in agar. Scale bar represents 20 μm .

P. clandestina has some characters in common with *P. cactorum* (Leb. et Cohn) Schroet., *P. iranica* Ershad(4) and *P. pseudotsugae* Hamm and Hansen(6), but differs from them in its slower growth rate, characteristic hyphal swellings and commonly subterminal or digitate antheridia. The frequent occurrence of a prominent basal plug in the sporangia of *P. clandestina* is also a character not recorded for these other fungi. In addition *P. clandestina* is distinguished from *P. cactorum* by the frequent occurrence of amphigynous antheridia in culture and from both *P. pseudotsugae* and *P. iranica* by its markedly aplerotic oospores. The recent discoveries of *P. iranica*, *P. pseudotsugae* and now *P. clandestina* show that the frequent production of both amphigynous and paragynous antheridia by a *Phytophthora* sp. with papillate sporangia sensu Waterhouse (20,12) is not as unusual as was previously thought(6).

ACKNOWLEDGEMENTS

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TAXONOMIC NOTES ON SOME POWDERY MILDEWS (V)

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The following descriptions and combinations are included in this paper: Erysiphe magnicellulata U. Braun var. robusta (Zheng & Chen) U. Braun stat. nov., E. glycines Tai var. lespedezae (Zheng & U. Braun) U. Braun & Zheng stat. nov., Microsphaera menispermii Howe var. dahurica U. Braun & Y. Nomura var. nov., M. menispermii var. sinomenii (Yu) U. Braun stat. nov., M. subtrichotoma U. Braun spec. nov., Uncinula togashiana U. Braun var. rigida U. Braun & S. Tanda var. nov., U. wuyiensis (Chen & GAO) U. Braun comb. nov., Uncinuliella simulans (Salm.) Zheng & Chen var. tandae U. Braun stat. & nom. nov., and Sawadaia polyfida (Wei) Zheng & Chen var. japonica U. Braun & S. Tanda var. nov. Furthermore, a short survey of the genus Phyllactinia in North America is given.

1. Erysiphe magnicellulata U. Braun var. robusta (Zheng & Chen) U. Braun stat. nov.

Bas.: Erysiphe robusta Zheng & Chen, Sydowia 34, p. 296 (1981).

I have studied additional material on Polemonium linifolium Vass., collected in the Far East of the USSR. The sample is from the herbarium of the Far East State University, Vladivostok. The Erysiphe on Polemoniaceae (E. magnicellulata) is well characterized by the appearance of the mycelium (dense, persistent patches or covers) and large (10-30 μ m diam.), thick-walled, conspicuous peridium cells. This species is widely distributed on Phlox, especially in N. America. Collections on some species of Polemonium in N. America and Europe coincide well with E. magnicellulata, and the samples on Polemonium chinense and linifolium in Asia (China, Far

East of the USSR) are largely agreeing, too. They differ, however, by very broad appendages, (4-) 6-13 (-18) μm , and peridium cells that reach 40 μm in diam. These minor differences are not sufficient to recognize a separate species. Therefore, I prefer a comprehensive Erysiphe on Polemoniaceae, separated into two varieties.

2. Erysiphe glycines Tai var. lespedezae (Zheng & U. Braun) U. Braun & Zheng stat. nov.

Bas.: Erysiphe lespedezae Zheng & U. Braun, Mycotaxon 18(1), p.142 (1983).

E. glycines and lespedezae are two very closely related taxa, well characterized by scattered ascocarps, long, hyaline or only pale yellow, very slender appendages and fairly numerous ascospores (4-8). The number of ascospores provides the only clear difference between E. glycines and the Lespedeza-Erysiphe (4-7-spored in the former and 6-8-spored in the latter species). Recent investigations of additional Japanese collections of E. glycines showed that there are specimens of this species with 6-7-spored asci. The difference between these taxa is too small to warrant a recognition of separate species. The Lespedeza fungus is hardly more than a variety of E. glycines.

3. Microsphaera menispermii Howe s.str. and allied taxa

M. menispermii is distributed in North America on Menispermum canadense. The cleistothecia are (80-) 100-135 (-145) μm in diam., appendages (6-) 8-18 (-20), the apex is rather compact, closely branched (fig. 1). Two geographically isolated taxa on other hosts of the Menispermaceae are very near to M. menispermii; they coincide in most essential features. A powdery mildew on Menispermum dauricum in Japan deviates from the fungus on M. canadense by a different mode of branching. The branchings are looser and characteristically angular. Microsphaera sinomenii Yu, described on Sinomenium acutum from China, differs from both taxa on Menispermum by fairly few appendages (ca. 5-11) and smaller ascocarps (ca. 70-115 μm in diam.). A separation on varietal rank seems to be appropriate.

Microsphaera menispermii Howe var. sinomenii (Yu) U. Braun stat. nov.

Bas.: Microsphaera sinomenii Yu, Acta Microbiol. Sinica 21(1), p.10 (1981).

Microsphaera menispermii Howe var. dahurica U. Braun & Y. Nomura var. nov.

Mycelium amphigenum, subpersistens, conidia non cate-nulata, ellipsoideae (-doliiformae), ca. 30-40 x 15-20 μm . Cleistothecia sparsa (-subgregaria), 90-120 μm diam.,

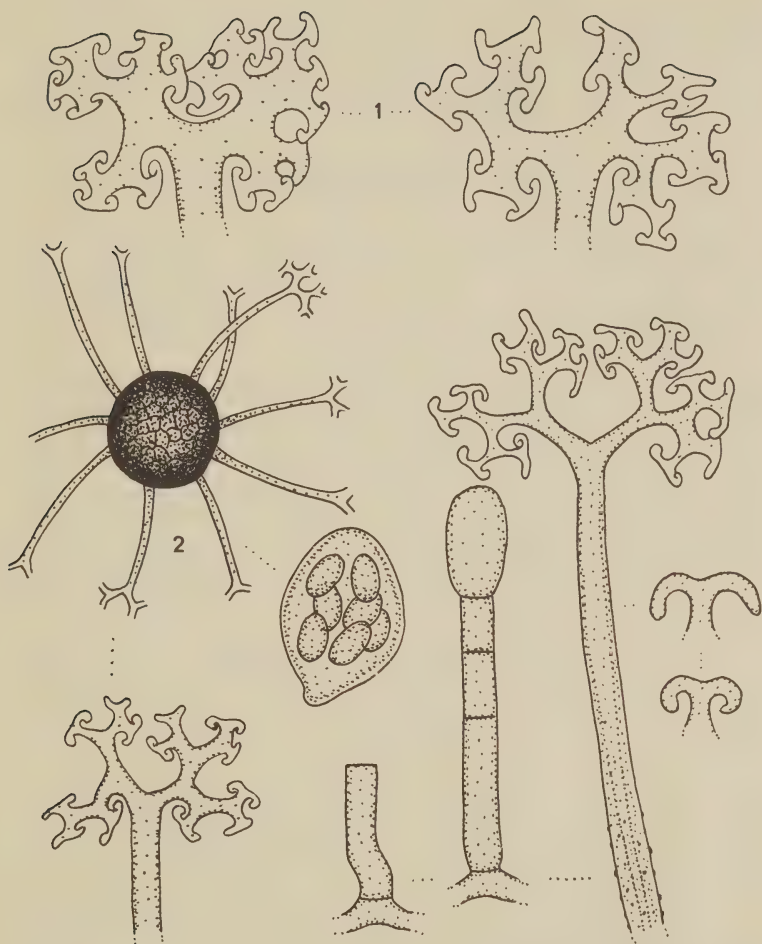


Fig. 1-2. Microsphaera menispermi var. menispermi (1), branchings of the appendages. M. menispermi var. dahurica (2), ascocarp, ascus, appendages, conidiophores. U. Braun del.

cellulae peridii irregulariter angulatae, ca. 10-20 μm diam., appendices 4-18, diametro cleistothecii 0.75-1.5 plo longiores, hyalinae, 0-2-septatae, superne tenui-, inferne crassitunicatae, ad basim 7-10.5 μm latae, ad apicem dichotome ramosae (4-6x), ramis ultimis recurvatis, asci 4-7, 45-70 x 35-50 μm , ascosporae (5-) 6-7 (-8), 16-25 x 10-14 μm . Fig. 2.

Holotypus: hospes - Menispermum dauricum DC., Japan, Oenohara T., Kanagawa Pref., 23-9-1981, Y. Nomura, YNMH 6758-2 (HAL). Isotypus: herb. Nomura.

This fungus has been discussed and illustrated in Tanda, Nomura and Matsunami (1977, pl. X, fig. 1-8).

4. Microsphaera subtrichotoma U. Braun spec. nov.

Syn.: M. robiniae ss. auct. non Tai

Mycelium amphigenum vel carpogenum, subpersistens, conidia non catenulata, ellipsoideae (-ovoideae), ca. 26-38 x 13-18 μm . Cleistothecia gregaria vel subsparsa, (70-) 80-125 (-145) μm diam., cellulae peridii irregulariter angulatae, ca. 8-25 μm diam., appendices (2-) 4-10 (-13), diametro cleistothecii 1-3, saepe 1.5-2 plo longiores, rigidae, hyalinae, superne tenui-, inferne crassitunicatae, 0-1-septatae, ad basim 9-13 μm latae, ad apicem dichotome - trichotome ramosae (4-8x), compactae, ramis ultimis non recurvatis, asci 4-15, (40-) 45-60 (-65) x 25-40 μm , ascosporae (3-) 4-5 (-6), ellipsoideae, 15-23 x 9-13 μm . Fig. 3.

Holotypus: hospes - Robinia pseudacacia L., USSR, Far East, Primorskiy Kr., Vladivostok, IX. 1972, Bunkina (herb. of the Far East State University, Vladivostok). Paratypi: hospes - R. pseudacacia, China, HMAS 39029, 41446, 41447.

This species seems to be allied to M. palczewskii Jacz. It is well characterized by appendages with very richly, compactly, often trichotomously branched apical parts. The branchings show a tendency to form a main axis which grows on and bears lateral branchings or outgrowth or even opposite sets of such structures.

Bunkina (1979) described and illustrated this fungus under M. robiniae, and Yu and Lai identified some agreeing Chinese samples on Robinia as well as two collections on Indigofera spec. (HMAS 41456) and Lespedeza bicolor Turcz. (HMAS 41455) with M. robiniae, too. The collections on Indigofera and Lespedeza pertain clearly to M. diffusa C. & P. They differ from M. subtrichotoma by numerous appendages (ca. 9-25) and a distinct mode of branching. I have revised the type of M. robiniae Tai (HMAS 05523). This species, only known from the type, is not closely related to M. subtrichotoma. It is, however, near to M. hedysari U. Braun, M. thermopsisidis U. Braun, and M. alhagi (Golovin) U. Braun. The cleistothecia of M. robiniae

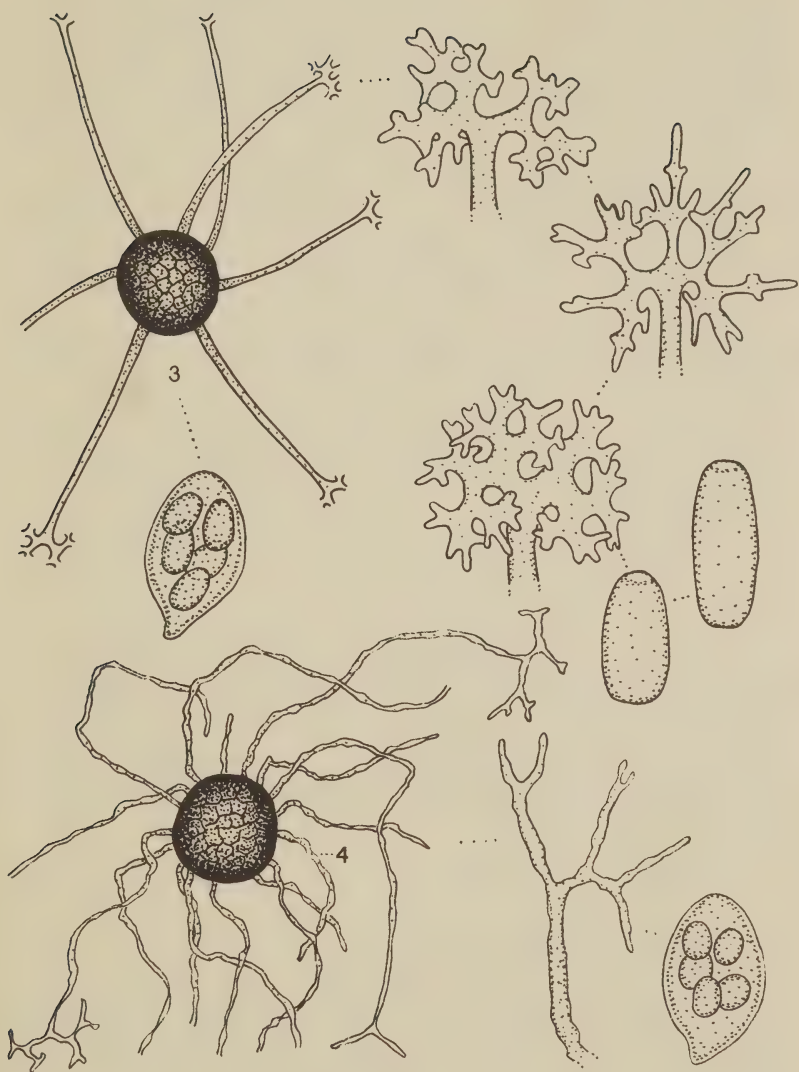


Fig. 3-4. Microsphaera subtrichotoma (3), ascocarp, ascus, apical parts of the appendages, conidia. M. robiniae (4), ascocarp, ascus, apex of an appendage. U. Braun del.

are 85-145 μm in diam., appendages numerous, 6-25, mostly 10-20, 1-3 times as long as the cleist. diam., very irregular, flexuous, lax, strongly geniculate-undulate, hyaline, 0-2-septate, thin-walled, somewhat thicker toward the base, smooth or only faintly rough below, (3-) 4-10 (-12) μm wide, apex simple or 1-5 times loosely branched, diffuse, tips not recurved, 6-13 asci, 50-70 x (25-) 30-45 μm , (4-) 5-6 (-7) spores, 14-20 x 10-15 μm (fig. 4).

5. Uncinula togashiana U. Braun var. rigida U. Braun & S. Tanda var. nov.

Cleistothecia sparsa, ca. 80-90 μm diam., appendices 15-25, diametro cleistothecii 1-2 plo longiores, rigidae, asci 3-7, 40-60 x 30-45 μm , ascosporae 3-5, 15-24 x 9.5-14 μm . Fig. 5.

Holotypus: hospes - Pterostyrax hispida Sieb. & Zucc., Japan, Yamanashi Pref., Masutomi Spa, Kitakoma-gun, 9-10-1983, Tanda (TUAMH 2207). Isotypus: HAL.

The fungus on Pterostyrax coincides largely with U. togashiana. It differs, however, in the structure of the appendages. They are rather stiff and regular in var. rigida and more irregular and frequently geniculate in var. togashiana.

6. Uncinula wuyiensis (Chen & Gao) U. Braun comb. nov.

Bas.: Furcuncinula wuyiensis Chen & Gao, Acta Mycol. Sinica 1(1), p.11 (1982).

The apex of the appendages is uncinuate and the tip is very shortly bi- to trifid with recurved or uncinuate branchlets. This type of appendages is fairly unusual, but it does not warrant a separate genus. The genus Uncinula possesses numerous "odd" species, e.g. U. paradoxo Simonian, U. nothofagi Thax. or U. forestalis Mena, all with unusual features. The recently separated genera (Uncinuliella, Bulbouncinula) possess differences in the basic characteristics.

7. Uncinuliella simulans (Salm.) Zheng & Chen var. tandae U. Braun stat. et nom. nov.

Bas.: Uncinuliella rosae Zheng & Chen, Acta Microbiol. Sinica 19(3), p.284 (1979).

Zheng and Chen (l.c.) described three taxa in their comprehensive revision of the genus Uncinuliella on Rosa: U. rosae and U. simulans var. simulans, both on Rosa multiflora in Japan, and U. simulans var. rosae-rubi on R. rubus in China. I have reinvestigated the type of U. rosae, which is very close to U. simulans. It agrees in all essential features and differs only by smaller ascocarps (70-110 μm diam.), 3-5 (-6)-spored asci and appendages which are only coloured near the base. U. rosae is hardly more than a variety of U. simulans. It is named after Dr. S. Tanda (Tokyo), the collector of the type specimen.

8. Sawadaia polyfida (Wei) Zheng & Chen var. japonica U. Braun et S. Tanda var. nov.

Cleistothecia similia eis typi; saepe 150-200 μ m diam. Fig. 6.

Holotypus: hospes - Acer palmatum Thunb. var. matsumurae Mak., Japan, Tokyo, 9-11-1983, Kawai (TUAMH 2408).

Isotypus: HAL.

Japanese Sawadaia collections on Acer palmatum, tenuifolium and sieboldianum are very well agreeing with S. polyfida. The appendages are very numerous (more than 100, reaching 250) and richly branched (2-3 x). The ascocarps of the Japanese collections are, however, constantly smaller (usually about 150-200 μ m in diam., average less than 200 μ m, rarely reaching 250 μ m; ascocarps of var. polyfida generally more than 200 μ m, reaching 300 μ m). Some collections of var. japonica have been described and illustrated in Tanda, Nomura and Matsunami (1977), Nomura, Tanda and Matsunami (1978) and Tanda and Nomura (1978).

9. The genus Phyllactinia in North America

The morphology of the taxa in Phyllactinia is very uniform and our knowledge about the biological specialization is too poor. Therefore, I prefer a comprehensive Phyllactinia guttata; only few segregate species are recognized.

Key to the species

1. Conidia characteristically angular, often somewhat constricted centrally or + cylindric (fig. 8), 35-60 (-80) x 16-26 (-30) μ m, on Fagaceae (Castanea, Fagus, Quercus) and Ulmus ... (a.) Phyllactinia angulata (Salm.) Blumer
 - 1' Conidia + clavate, not angular (fig. 7), ca. 40-90 x 10-25 μ m 2
 2. Cleistothecia agreeing with Ph. guttata, but asci frequently 3-spored, seldom 4-sp., on Oleaceae (Fraxinus) (b.) Ph. fraxini (DC.) Fuss
 - 2' Asci constantly 2-spored, very rarely 3, on other host families 3
 3. Cleist. ca. 140-250 μ m in diam., seldom slightly exceeding, on various hosts (c.) Ph. guttata (Wallr.: Fr.) Lév.
 - 3' Cleist. larger, ca. 220-280 μ m in diam., on Eleagnus argentea (d.) Ph. eleagni Linder
 - 3'' Cleist. fairly small, ca. 140-185 μ m in diam., average below 170 μ m, on Crataegus (e.) Ph. mali (Duby) Braun
- (a.) Phyllactinia angulata (Salm.) Blumer, Beitr. Krypt.-Fl. Schweiz 7(1), p.399 (1933)
- Syn.: Ph. coryleae var. angulata Salm., Ann. Myc. 3, p.

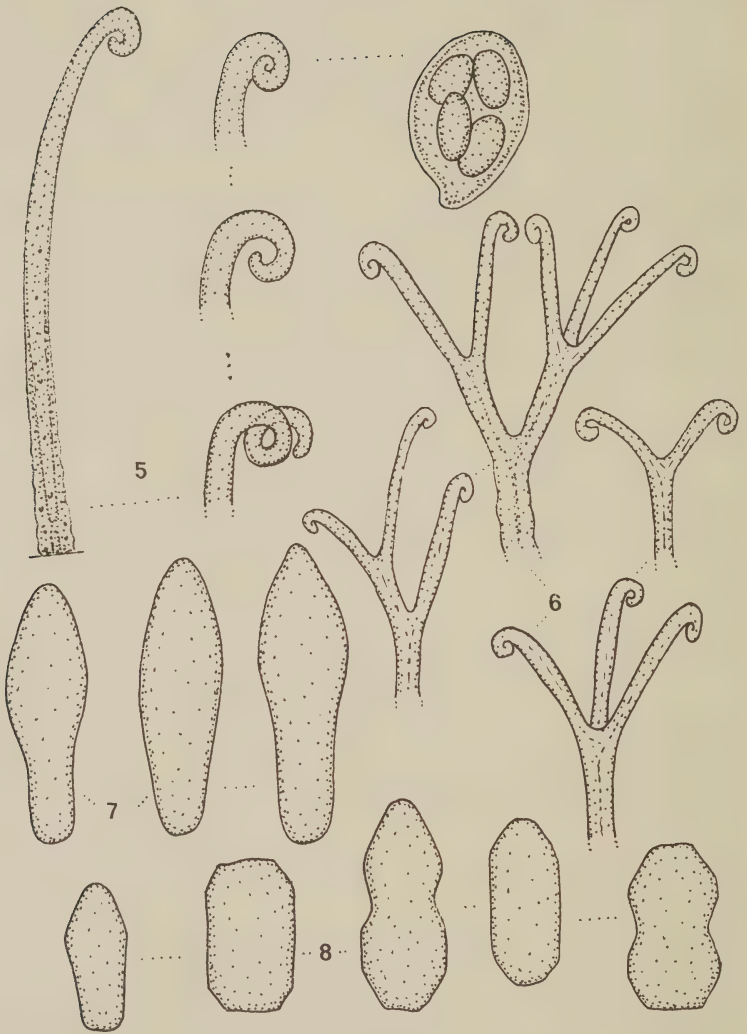


Fig. 5-8. Uncinula togashiana var. rigida (5), appendage, apical parts, ascus. Sawadaia polyfida var. japonica (6), appendages, apical parts. Phyllactinia guttata (7), conidia. Ph. angulata (8), conidia. U. Braun del.

500 (1905).

This species is well characterized by the conidial shape; the mycelium is always well developed, conspicuous, persistent, and the ascocarps are mostly fairly large (ca. 185-310 μ m). They are mostly about 200-280 μ m in diam. All American Phyllactinia samples on diverse hosts of the genera Castanea, Fagus and Quercus pertain to Ph. angulata. The N. American Ulmus Phyllactinia is morphologically fully agreeing with this species.

(b.) Phyllactinia fraxini (DC.) Fuss, Arch. Ver. Siebenb. Naturk. 14(2), p.463 (1878)

Syn.: Ph. fraxini (DC.) Homma, J. Fac. Agric. Hokkaido Imp. Univ. 38, p.409 (1937). Alphitomorpha lenticularis Wallr., Fl. Crypt. Germ. 2, p.759 (1833). Ph. suffulta var. blumeri de Mendonça & Sequ., Agron. Lusit. 24(2), p. 107 (1962). Ph. guttata var. blumeri (de Mendonça & Sequ.) U. Braun, Gläditschia 6, p.172 (1978).

The species is widely distributed in North America on various hosts of the genus Fraxinus. It is a specialized taxon, distinguished from Ph. guttata by frequently 3-sp. asci. Within the very uniform Ph. guttata complex, this feature seems to be sufficient to recognize Ph. fraxini.

(c.) Phyllactinia guttata (Wallr.: Fr.) Lév., Ann. Sci. Nat., bot., 3 sér., 15, p.144 (1851)

Syn.: Ph. suffulta (Rebent.) Sacc., Syll. Fung. 1, p. 5 (1882). Ph. corylea (Pers.) Karst., Act. Soc. Faun. Fl. Fenn. 2, p.92 (1885).

The present concept of Ph. guttata is wide. The species occurs in N. America on numerous hosts of diverse families. I have studied American material on hosts of the following genera: Alnus, Amelanchier, Berberis, Betula, Carpinus, Celastrus, Cornus, Crataegus, Hamamelis, Ilex, Liriodendron, Morus, Ostrya, Philadelphus, Populus, Ribes, Vaccinium, Xanthophyllum.

(d.) Phyllactinia eleagni Linder, Mycologia 35, p.467 (1943)

It should be discussed if the name can be changed to "eleagni". I have revised the type of this species (ex FH), but I have not seen conidia. The ascocarps are fairly large. Provided that the conidia are clavate, Ph. eleagni can be recognized. However, if the conidia are angular, it could be a synonym of Ph. hippophaës or angulata.

(e.) Phyllactinia mali (Duby) U. Braun, Feddes Repert. 88, p.657 (1978)

Syn.: Ph. mespili (Cast.) Blumer, Beitr. Krypt.-Fl. 7(1), p.396 (1933). Ph. pyri (Cast.) Homma, J. Fac. Agric. Hokkaido Imp. Univ. 38, p.412 (1937).

In N. America there are two species of Phyllactinia

on Crataegus, Phyllactinia guttata (cleist. ca. 170-250 μm in diam., e.g. on Crataegus rivularis and tomentosa) and Ph. mali (cleist. small, ca. 140-185 μm in diam., average below 170 μm , e.g. on Crataegus douglasii and parvifolia). Collections on other hosts of the Rosaceae in N. America belong to Ph. guttata. Ph. mali is widely distributed in Europe on Crataegus, Malus, Mespilus and Pyrus.

Acknowledgements

I wish to express my sincere thanks to Dr. I. A. Bunkina (Vladivostok), Dr. Y. Nomura (Yotsukaido C., Chiba Pref., Japan), Dr. S. Tanda (Tokyo, TUAMH) and Prof. Dr. Zheng (Beijing, China, HMAS) for the provided collections and the kind co-operation.

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HYMENOCHAETE CRUENTA (PERS.:FR.) DONK NEW TO SOUTH¹
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During a taxonomic study of the genus *Hymenochaete* Lévl. for Southern South America, a collection was found from Tierra del Fuego that coincides with the description of *H. cruenta* (Pers.:Fr.) Donk, perhaps better known as *H. mougeotii* (Fr.) Cooke. This species does not appear to have been recorded so far from the American continent (Defigio, 1970).

H. cruenta has been considered distinctly Euroasiatic, but was recorded by Cunningham (1963) for Australia and New Zealand. We believe it is of interest to describe this species on the basis of our material.

HYMENOCHAETE CRUENTA (Pers.:Fr.) Donk, Persoonia 1 (1): 51. 1959.

- = *Thelephora cruenta* Pers.: Fr., Syst. Mycol. 1: 444. 1821.
- = *T. mougeotii* Fr., Elench. Fung. 1: 188. 1828.
- = *Corticium mougeotii* Fr., Epicr. p. 558. 1838.
- = *H. mougeotii* (Fr.) Cooke, Grevillea 8: 147. 1880.
- = *H. sphaericola* Lloyd, Mycol. Notes 74: 1338. 1925.

Basidiocarp adnate, resupinate, membranous, smooth; hymenial surface purple ("Indian purple", Pl. 47 L 2, according to Maerz & Paul, 1930); margin thin, concolorous.

Fruitbody 250-300 μ m thick (Fig. 1 a). Cuticle present, compact, formed by thick-walled, intertwined and cemented hyphae. Abhymenial hairs scant. Context well developed, formed by loosely woven hyphae, 2-3 μ m diam., with ascending orientation. Setal stratum seated on context, 80-120 μ m thick, formed by 2-3 rows of irregularly arranged setae. Setae 55-90 x 8-12 μ m, with acuminate apices, naked, lumen scarce, standing out up to 50 μ m over the hymenial layer. Hymenium composed of paraphyses, basidia and basidioles. Paraphyses dendriform, originating in the context and slightly projecting over the hymenium; basidia subclaviform, 18-22 x 4-5 μ m, with 4 curved sterigmata each; spores subballantoid, 6-8 x 2.5-3.5 μ m, smooth, hyaline (Fig. 1 b).

Material studied: ARGENTINA, Tierra del Fuego: Puerto Harberton, Leg. Wright & DeI Busto, II.1973 (BAFC 29.230).

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2 Fellow of the above Council.

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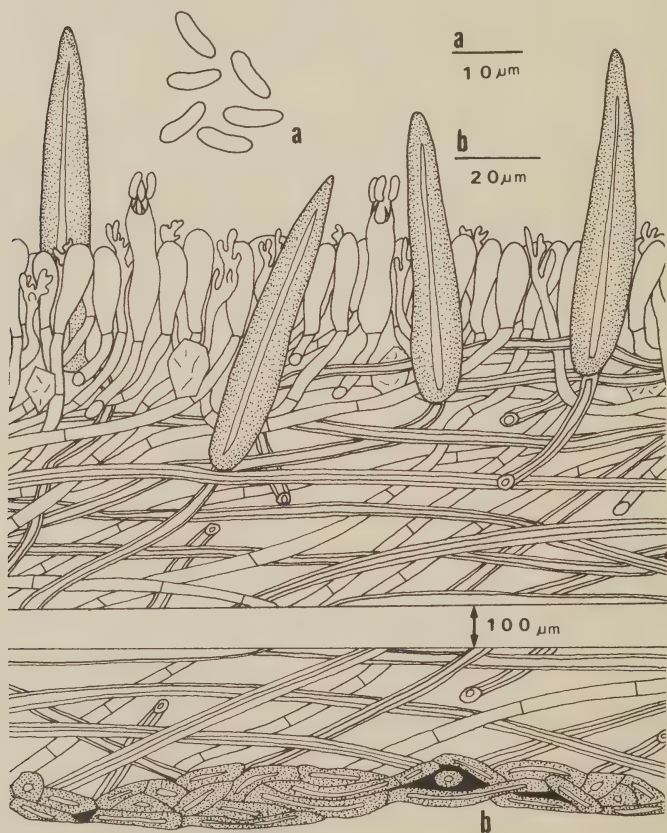


Fig. 1. Cross section through the fruitbody of *Hymenochaete cruenta*. a: spores; b: detail of the basidia, setae and hyphae; in the lower part the amalgamated hyphae can be seen. Arrow in the middle portion indicates thickness.

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NOTES ON THE GENUS DACRYOPINAX FROM CHINA

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ABSTRACT

Dacryopinax spathularia is widely distributed in different localities of China, and D. fissa is found in the Omei Mts. and Taiwan. A new species, D. xizangensis, is described, occurring on rotten wood of Abies forrestii Rogers, from the southern slope of the Eastern Himalayas, China.

Key words: Dacrymycetaceae, Dacryopinax, China.

SUMMARY

摘 要

中国分佈的花耳属, 现知三種。其中花耳 Dacryopinax spathularia 習見于中国广大地区; 桂花耳 D. fissa 现知見于台湾和四川峨眉山; 新種西藏花耳 D. xizangensis 僅見于西藏墨脱一带的弗氏冷杉 Abies forrestii Rogers 腐木上, 本文对此作了描述和附圖。

关键词: 花耳 Dacryopinax spathularia
桂花耳 Dacryopinax fissa 和西藏花耳
Dacryopinax xizangensis。中国 China。

Since the genus Dacryopinax Martin was described in 1948, McNabb (1965) reviewed 7 species in the genus, and Lowy (1971) included 6 species from the neotropics in his monograph, two of which were described as new. The genus is mainly of tropical and warm temperature distribution and heretofore in China, only two species of the genus have been recorded (Teng, 1963; Tai, 1979; Wang & Zang, 1983). Nevertheless, the knowledge of Dacryopinax in China appears to be incomplete. Dacryopinax spathularia (Schw.) Martin is widely distributed in China, having been recorded as occurring on the Changbai Mts. in the north, southward to Yunnan and Hainan Island, east from Fujian, and westward to Nyalam



Figs. 1-6. *Dacryopinax xizangensis* Lowy et Zang (HKAS 13044). 1. Habit sketch (del. Zheng Xiao-lian), 2. Basidiocarps. 3. Vertical section of basidiocarp. 4. Abhymenial hairs. 5. Basidiospores. 6. Probasidium and metabasidia.

(Congdu) County of Xizang (Tibet) (Fig. 7). The other species, *D. fissa* (Berk.) Martin is found from Taiwan to the Omei Mts. of Sichuan (Fig. 7). It probably occurs in southern and southwestern China as well. Recently, some extensive collecting was carried out in several regions of the Eastern Himalayas and the Hengduan Mountains as part of an ongoing study of the mycoflora (Zang & Zong 1981, 1983), where a new tropical species, *Dacryopinax xizangensis* has been found. This species is known only from the Medog on the southern flank of the Eastern Himalayas (Fig. 7), where a series of varied ecological conditions prevail. The tropical monsoon rain forest below, and the alpine *Abies* forest above retain the warmer and wetter air currents from the Indian Ocean. These conditions are highly favourable for the development of tropical and subtropical fungi.

Key to the species of *Dacryopinax* known from China

1. Basidiocarps spatulate to petaloid, long-stipitate, 2.5-4 X 0.2-0.6 cm, smooth. Basidiospores ovate or cylindroid, becoming 1-septate 2
1. Basidiocarps discoid to subcupulate; short-stipitate, 0.5-0.9 X 0.1-0.5 cm, tomentose. Basidiospores muriform, becoming 4-6 septate.... 3. *Dacryopinax xizangensis*
2. Broad, simple or more or less branched. Hymenial surface folded... 1. *D. spathularia*
2. Irregularly or palmately branched; lobes narrow. Hymenial surface almost smooth..... 2. *D. fissa*
1. *Dacryopinax spathularia* (Schw.) Martin, Lloydia 11:116. 1948.
= *Merulius spathularia* Schweinitz, Schr. Naturf. Ges. Leipzig 1:32. 1822.
= *Guepinia spathularia* (Schw.) Fries, Elench. Fung. 2:32. 1828.

Specimens examined: YUNNAN. Gaoligong Shan (Gaoligong Mountains), Bijiang County, on rotten wood of *Pinus yunnanensis* Fr. 1200 m alt. 3 VII 1978. Zang Mu 901 (HKAS 3901); Dai Autonomous Prefecture of Xishuangbanna. VII 1980. Li Xing-jiang 01; SICHUAN (Szechwan Province). Yanyuan (Yi Autonomous County of Yanyuan). 3850 m alt. 9 VIII 1983. Chen Keke 493 (HKAS 13436); XIZANG (Tibet Autonomous Region). Mainling County (Tungdor), Jia Ge, on rotten wood. 26 VII 1975. Zang Mu 365 (HKAS 5365); Nyalam (Congdu) County. VII 1982 Hwang 01; Yadong (Chomo) County. VII 1982. Hwang 002; GUIZHOU (Kweichow Prov.). Fanjingshan Mountains, 1980. Ho 9. (Herbarium of the Academy of Sciences of Guizhou). Other collections: According to Teng (1963), F.L. Tai (1979), Wang & Zang etc. (1983) indicated that it also occurs in the following localities from China: HEBEI (Hopei Province). Xiao Wu Tai Shan (Xiaowutai-shan Mts.); SHANXI (Shansi Province). Wutai Mountains; JILIN (Kirin Province). Changbai Mountains; GANSU. Tibetan Autonomous Prefecture of Ganan; JIANGSU (Kiangsu Province). Yixing Xian (Iching County); ANHUI (Anhui Province). Huang Shan (Yellow Mountains); ZHEJIANG (Chekiang Province). Xi Tianmu Shan (West Tianmu Mountains); JIANGXI (Kiangsi Province). Lu Shan (Lushan Mountains); FUJIAN (Fukien Province). Wuyi Shan (Wuyi Mountains); HUBEI (Hupei Province). Shennongjia County; HUNAN. Yuelu Shan (Yuelu Mountains). GUANGDONG (Kwangtung Province). Zhaoqing Prefecture. HAINAN DAO (Hainan Island). Wuzhi Shan (Wuzhi Mountains); GUANGXI (Zhuang Autonomous Region of Kwangsi), Shiwan Dashan (Shiwan Mountains).



Fig. 7. Distribution of *Dacryopinax* in The People's Republic of China. Squares: *D. spatularia*. Circles: *D. fissa*. Asterisk: *D. xizangensis*.

2. *Dacryopinax fissa* (Berk.) Martin, *Lloydia* 11:116, 1948.

= *Guepinia fissa* Berk. *Ann. Mag. Nat. Hist.* 10:383, 1843.

Specimens examined: Sichuan (Szechwan Province). Omei Mts. 30 VII 1944. Shen 106. (Herbarium of Nanjing Teacher's Univ.). Other collections: Taiwan. (Kobayasi, 1939, Sawada, 1959).

Although Martin (1948) considered this to be synonymous with *D. spathularia*, I found it sufficiently distinct in our collections to retain its status as a separate species.

3. *Dacryopinax xizangensis* Lowy et Zang, sp. nov. FIGS. 1-6.

Basidiocarpus dispersus, gregarius vel subcespitosus, substrato adhaerens, discoideus, subdiscoideus, cupuloideus vel irregulariter foliaceus, 1-5 cm diam. cartilagineo-gelatinosus, basi stipitato vel numeroso-stipitatis. Margine tenui, integra, undulata, in sicco margo revolutus. Stipes 0.5-0.9 X 0.1-0.5 cm, sparse villosus, sursum incrassatus, basim versus attenuatus, albus vel albo-flavus. Hymenium planum-concavum, flavum, aurantiacum, carneum vel armentiacum, in vivo elastico-gelatinosum vel molliusculum, in sicco subalutacum vel subcrustacum. Probasidia cylindracea, $\pm$ 58-65 X 6-8 μ m. Metabasidia aseptata, bifurcata, 60-80 X 6-9 μ m, in gelatina immersa. Basidiosporae subcylindraceae vel subovoideae, hyaline vel subhyalinae, 24-27 μ m longae, 12-13.5 μ m latae, muriformiter septatae, septatis 3-6, interdum in medio cellulis biseriatis. Abhymenium vesiculo-pilosum, seriatum, multicellulare, catenatum, 8-10 μ m latum. Fibulae absunt.

In ligno carioso *Abietis forrestii* Rogers, 3250 m alt. Xizang (Tibet Autonomous Region). Motou (Medog), Gou Bu La. 20 XI 1982. Su Yungge 2428 (HKAS 13044, Typus).

Basidiocarps scattered, gregarious or subcespitose, closely adhering to the substratum, orange to orange yellow, usually discoid subdiscoid or subcupulate, sometimes becoming irregularly foliaceous, 1-5 cm diam, cartilaginous-gelatinous, attenuated below into a stipe or narrowed base, sometimes with numerous stipes. Stipe 0.5-0.9 X 0.1-0.5 cm, villous, whitish, whitish yellow, or whitish orange. Margins thin, entire or undulate, rolled back from edge when dry. Hymenium at first nearly plane, becoming more or less subcrustaceous, orange yellow, flesh to apricot-coloured. Probasidia cylindrical, up to $\pm$ 58-65 X 6-7 μ m. Metabasidia aseptate, narrowly clavate, forked into two stout sterigmata, 60-80 X 6-9 μ m, imbedded in gelatinous material; a single basidiospore produced at the apex of a sterigma. Basidiospores subcylindrical to subvoid, hyaline or subhyaline 24-27 X 12-13.5 μ m, muriform, becoming 3-6 septate and slightly constricted at the septa, 1-2 of the median cells longitudinally divided; surface of abhymenium with sparse, vesicular, catenate hairs, hyaline, 80-200 X 8-11.7 μ m, occurring singly or in fascicles. Hyphae in a gelatinous matrix, subhyaline, branched, interwoven, smooth, 1.5-2.5 μ m diam, hyphal apices more or less distinctly tortuous. No clamp connections seen.

Dacryopinax xizangensis appears to be closest to *D. martinii* Lowy in its external characteristics (Lowy, 1971), however it may be distinguished from the latter by its muriform basidiospores, presently a unique feature of the genus. Moreover, the sections of the basidiocarp also reveal that the abhymenium produces weak hairs which are made up of catenate, inflated cells (Fig.4). It is known only from the type collection.

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INFRAGENERIC TAXA IN STEREUM, AND KEYS TO NORTH AMERICAN SPECIES

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ABSTRACT

Three subgenera earlier proposed for Stereum (Acanthostereum, Aculeatostereum and Stereum) by Boidin et al. are accepted. Two sections of Stereum subg. Stereum are informally proposed, based on the presence or absence of a distinct cutis. Keys to North American species are provided.

Fries (1838) solidified the concept of Stereum Hill ex Persoon, the foundations for which were laid in his Systema (1821) as an infrageneric division of Thelephora. That concept remained the dominant one well into the twentieth century, as reflected in the Thelephoraceae of North America, Part XII (Burt, 1920). Stipitate, pileate, effuso-reflexed and resupinate forms with upturned margins were represented, most with smooth hymenial surfaces and with hyaline, unornamented spore walls.

Between 1955 and 1968 the concept of Stereum became increasingly narrow. The truly stipitate species were placed in genera such as Aquascypha Reid, Cotylidia Karsten, Cyphellostereum Reid, Cymatoderma Junghuhn, Inflatostereum Reid, Podoscypha Patouillard, and Stereopsis Reid. The taxonomic framework of this group was largely constructed by Reid (1965).

A concept of Stereum which excluded stipitate forms, although not yet fully developed, was adopted by Lentz (1955). He recognized some of the obvious microscopic dissimilarities among the non-stipitate sterea, erecting Laxitextum and exhuming Cryptochaete Karsten. Other differences were not given genus-level consideration.

Boidin (1958), Parmasto (1968) and Pouzar (1959) narrowed the existing concept of Stereum even further, leaving only those species which closely resembled the type species, S. hirsutum (Willd.:Fr.) S.F. Gray. To this end Amylostereum Boidin, Boreostereum Parmasto, Chondrostereum Pouzar, Columnocystis Pouzar, Cystostereum Pouzar and Laurilia Pouzar were erected. Residual species have been placed primarily in genera such as Lopharia Kalchbrenner and MacOwan, Peniophora Cooke, Phanerochaete Karsten and Xylobolus Karsten.

Thus far, nearly all of these genera and generic transfers have gained acceptance. One exception concerns the genus Haematostereum Pouzar. One still sees this genus being used in forest pathology literature; it seems to have been adopted simply because it is "new." Haematostereum was based on the apparent monomiticity and presence of colored contents in conducting hyphae and pseudocystidia shown by basidiomata of S. gausapatum (Fr.:Fr.) Fr., S. rugosum Pers.:Fr. and S. sanguinolentum (Alb. and Schw.:Fr.) Fr.

Haematostereum has been rejected by those (including the present author) who have studied the sterea in a comparative fashion (Eriksson et al., 1984; Jahn, 1971; Jülich and Stalpers, 1980; Parmasto, 1968; Rattan, 1977; Welden, 1971). The color of pseudocystidial and conducting hyphal contents is a variable character (Chamuris, 1985; Welden, 1971), and is certainly not useful taxonomically at the generic or subgeneric level.

As for the other character - miticity - it appears that the hyphal system in Stereum does not fit readily into the "monomitic" and "dimitic" types proposed by Corner (1932). Talbot (1973) stated that Stereum had a dimitic hyphal system. Boidin (1958) and Boidin et al. (1979) also reported a dimitic system. Eriksson et al. (1984) claim that Stereum has a monomitic hyphal system, but Pouzar obviously felt that some species were monomitic and some were dimitic. Lentz (1960, p. 117) conceded that it

is difficult to define the genus as possessing one type of hyphal system or another. In my opinion Corner's classification is not appropriate for Stereum. Therefore, generic delimitation should not be undertaken based on miticity.

By 1968 the genus Stereum represented a homogeneous cluster of species that could be interpreted as comprising a "natural" group. Comparative study of morphology, cultural characters, and nuclear behavior support this interpretation.

Many species however, exhibit an amazing degree of variability in respect to certain characters such as aspect and gross morphology. Dependable characters that could be used to dissect the genus into discrete groups was desperately needed. Boidin et al. (1979) provided such a character: the presence or absence of acanthohyphidia or pseudoacanthohyphidia (Fig. 1c, 1d). Three subgenera were proposed: Acanthostereum, Aculeatostereum and Stereum.

TABLE 1. Terms used by various authors for hyphidial types important in subgeneric circumscription.

Present paper	acanthohyphidium	pseudoacanthohyphidium	hyphidium
Boidin et al. (1979)	acanthophysis	pseudoacanthophysis	basidiole or hyphidium
Burt (1920)	bottle-brush paraphysis	-	-
Eriksson et al. (1984)	-	acanthocystidium	acutocystidium
Jülich and Stalpers (1980)	acanthohyphidium	acanthohyphidium	cystidiole (?)
Lentz (1955, 1960)	acanthophysis	aculeate-tipped basidiole	basidiole

THE SUBGENERIC CHARACTER

Boidin et al. (1979) proposed three subgenera based on the presence or absence of acanthohyphidia and pseudoacanthohyphidia. Acanthohyphidia are thin- or thick-walled hymenial elements with cylindrical projections all along their length (Fig. 1d). They characterize the subgenus Acanthostereum. Species of Xylobolus (closely related to Stereum) and some Aleurodiscus species also possess acanthohyphidia.

Pseudoacanthohyphidia are thin-walled hymenial elements that bear a few (2-5, rarely up to 10) apical projections (Fig. 1c). Members of the subgenus Aculeatostereum possess pseudoacanthohyphidia. Acanthostereum species may have pseudoacanthohyphidia in addition to acanthohyphidia, but members of Aculeatostereum never possess true acanthohyphidia.

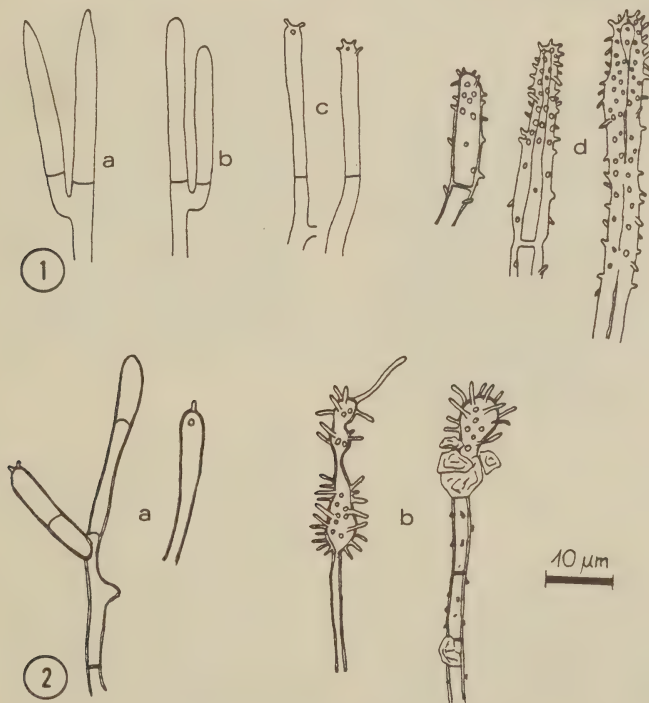
A third type of hymenial element is common to all three subgenera. These are referred to here as hyphidia. They are thin-walled and usually have acuminate apices (Fig. 1a), but occasionally have rounded apices (Fig. 1b). The various terms used to describe acantho-, pseudoacantho- and acuminate-tipped hyphidia are summarized in Table 1.

Jülich and Stalpers (1980) questioned the use of acantho- and pseudoacanthohyphidia in the taxonomy of Stereum. For example, in reference to S. (Aculeatostereum) sanguinolentum, they state that "(Pseudo-)Acanthohyphidia are mentioned in descriptions of American specimens, never in those of European ones". I have seen European material with pseudoacanthohyphidia. Eriksson et al. (1984) illustrate and describe pseudoacanthohyphidia in S. sanguinolentum. Also, Boidin et al. (1979) list S. sanguinolentum as a member of Aculeatostereum. These European authors must have examined European material.

The validity of using hyphidial type as a subgeneric character can be supported by the production of "versions" of the types in culture. Hyphal ends with a few apical outgrowths can be found in S. fasciatum and S. sanguinolentum - both members of Stereum subg. Aculeatostereum (Fig. 2a). These are associated with

hymenia, when the hymenia are well-developed and in the later stages of development (15-20 weeks on malt agar). Such hyphae could not be found in the hymenia formed by cultures of Stereum subg. Stereum species.

I have not studied cultures of Acanthostereum, but cultures of Xylobolus frustulatus and X. subpileatus produce acanthohyphidium-like elements (Fig. 2b). These observations suggest that acantho- and pseudoacanthohyphidia are structures with a stable genetic base, and are therefore of taxonomic value.



FIGS. 1 & 2. Hyphal elements important in subgeneric circumscription. 1. Hymenial elements from basidiomata produced in nature. Hyphidia with a) acuminate, and b) rounded apices (S. hirsutum); c) pseudoacanthohyphidia (S. fasciatum); d) acanthohyphidia (X. subpileatus). 2. From cultures. a) Pseudoacanthohyphidium-like structures (S. fasciatum); b) Acanthohyphidium-like structures (X. subpileatus).

TAXONOMY AND DISCUSSION

STEREUM Hill, Gen. Nat. Hist., Vol 2, Hist. of Plants, p. 34. 1751; ex Persoon, Neues Mag. Bot. 1:110. 1794.

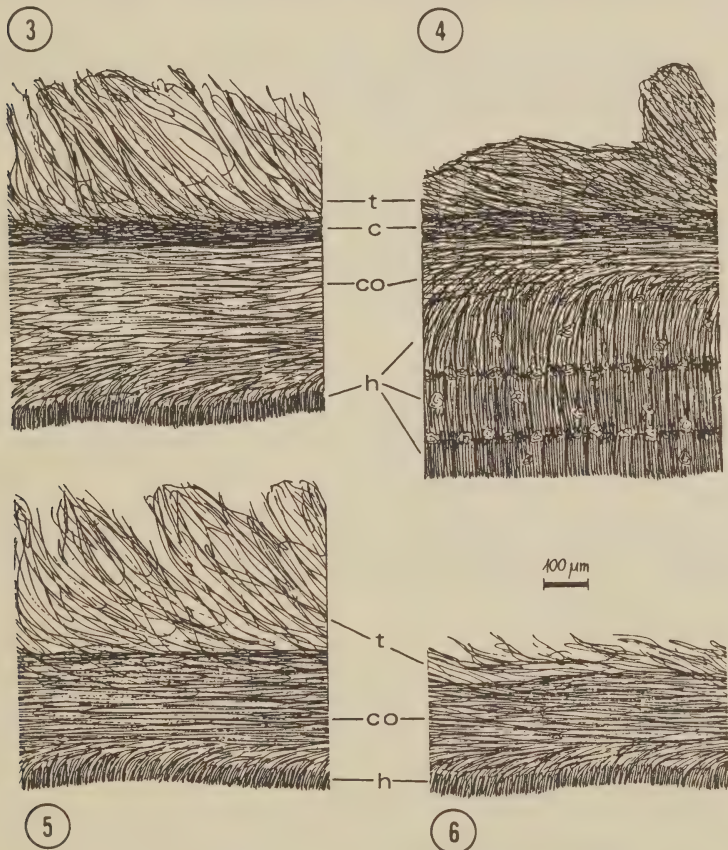
= Haematostereum Pouzar, Česká Mykol. 13:13. 1959.

Type species: Thelephora hirsuta Willd.:Fr.

Basidiomata annual or perennial; coriaceous, papery or hard; pileate, effuso-reflexed or resupinate; pilei substipitate, umbonate, flabelliform, petaloid, or dimidiate; concave, applanate, conchate; radially undulate, plicate or complicate; gregarious, caespitose, imbricate or not. Hymenial surface even or slightly tuberculate, cracking in older specimens, sometimes concentrically ridged; beige, cream, gray or yellow when fresh, often bruising or bleeding yellow, orange or dark red when injured. Tissue layers: hymenium simple or stratose, with crystals in age; context composed of parallel, radially arranged hyphae, pale-colored; compact brownish cutis usually present; tomentum derived from cutis or from context directly, tomentose, hirsute, strigose, hispid or shiny-appressed.

Hyphae of two types: 1) thin- to slightly thick-walled, hyaline, simple-septate, in and near hymenium, in hymenium giving rise to a) basidia and basidioles, b) thin-walled round- or acuminate-tipped hyphidia, c) in subgenus Aculeatostereum, thin-walled pseudoacanthohyphidia with a few (2-5, rarely up to 10) apical projections; 2) slightly thick-walled to almost solid, hyaline to yellowish brown, simple-septate or aseptate with retraction septa; in context, cutis and tomentum, bending toward and ending in the hymenium and subhymenium; in subgenus Acanthostereum modified in hymenium and subhymenium as acanthohyphidia with numerous cylindrical projections; in context, some with hyaline, yellowish or brownish oily contents (conducting hyphae), ending in hymenium and subhymenium as pseudocystidia. Basidia thin-walled, narrowly clavate to subcylindrical, with four sterigmata, contents homogeneous. Basidiospores ellipsoid to cylindrical, sometimes slightly curved, hyaline, thin-walled, smooth, amyloid, binucleate.

Monosporous and polysporous cultures very similar; mat at first white, low-cottony, woolly or downy, with floccose patches, usually becoming felty, often with shades of yellow, orange, brown and dark red. Hyphae multinucleate, thin-walled to solid, hyaline to yellowish, aseptate, simple-septate, or with 1-6 verticillate clamp connections per septum; hyphal coils often present; no special structures produced; fertile or sterile hymenia may be formed on agar media after extended periods of



FIGS. 3-6. Radial sections through pilei. 3. S. hirsutum. 4. S. rugosum. 5. S. ochraceo-flavum. 6. S. striatum. t, tomentum; c, cutis; co, context; h, hymenium.

incubation. Extracellular phenoloxidase activity variable, present as laccase and tyrosinase.

Habitat: Lignicolous on hardwood and coniferous tree species; some facultative parasites, usually entering through wounds, causing heart and sap rots; all saprobic; causing a white rot of fairly sound, usually corticate twigs, limbs and stems.

Distribution: Worldwide.

Several different layers or zones are evident when one examines radial sections through the basidiomata of Stereum species. These are illustrated in Figs. 3-6. They are: the hymenium (-ia), the context, the cutis (when present), and the tomentum.

The hymenium tends to thicken as the basidioma ages. In S. rugosum, a regularly perennial species, there is a series of hymenia which give radial sections a stratified appearance (Fig. 4). Occasionally other species have stratified hymenia, with rarely more than two strata.

The uppermost layer is the tomentum. This layer is of variable thickness, being exposed to the weathering agents of the biotic and abiotic environment. When a well-defined cutis is present (e.g. Figs. 3 and 4), the tomentum is derived from it and may then be called the epicutis. However in two species (S. striatum and S. ochraceo-flavum) such a cutis is lacking or poorly developed; the tomentum is derived from the pale-colored context. In this case the tomentum should not be referred to as an epicutis.

Key to the Subgenera of Stereum

Hymenium possessing acanthohyphidia,
pseudoacanthohyphidia, or both

Acanthohyphidia absent . . subg. ACULEATOSTEREUM

Acanthohyphidia present . . subg. ACANTHOSTEREUM

Hymenium lacking acanthohyphidia and
pseudoacanthohyphidia subg. STEREUM

STEREUM Hill ex Pers., subgenus ACANTHOSTEREUM Boidin, Parmasto, Dhingra and Lanquetin, Persoonia 10:320. 1979.

Hymenium with acanthohyphidia; pseudo-acanthohyphidia and acuminate-tipped hyphidia present; basidia and pseudocystidia rarely with short outgrowths.

Type species: S. peculiare Boidin, Parmasto and Dhingra.

Distribution: Eurasia. No North American species known.

STEREUM Hill ex Pers., subgenus ACULEATOSTEREUM Boidin, Parmasto, Dhingra and Lanquetin, Persoonia 10:320. 1979.

Hymenium with pseudoacanthohyphidia; acuminate-tipped hyphidia present; acanthohyphidia lacking; basidia and pseudocystidia rarely with short outgrowths.

Type species: S. insignitum Qué1.

Distribution: Worldwide.

TABLE 2. Characters used to distinguish members of the S. hirsutum-complex, sensu Chamuris.

	hirsutum	complicatum	versicolor
Distribution	temperate and tropical		tropical and subtropical
Tomentum	thick	scant or appressed	
Pileus surface	tomentose, hirsute, strigose or hispid; concentrically furrowed	glabrous or scantily tomentose, shining; concentrically zonate with thin, alternating bands of orange and brownish	
Pilei	solitary or gregarious; some confluence	caespitose; strongly confluent; often imbricate	solitary or gregarious
Pileus "folding"	applanate or radiately undulate	radiately complicate	applanate or concave

Key to North American Species
of *Stereum* subg. *Aculeatostereum*

Restricted to wood of coniferous trees
. *S. sanguinolentum*

On hardwoods

Basidiospores 7-12 x 3-6 μ m; basidiomata hard,
perennial, resupinate or with slightly reflexed
margins; rare in North America . . *S. rugosum*

Basidiospores 4-7 x 2-3 μ m; basidiomata
coriaceous, annual (occasionally biennial),
pileate, sub-stipitate or effuso-reflexed; common
in North America south of 42°N. Lat.
. *S. fasciatum* (The
use of this epithet is discussed by Chamuris
(1984).) (= *S. ostrea*, *S. lobatum*, *S. australe*)

STEREUM Hill ex Pers., subgenus STEREUM

Hymenium with acuminate-tipped hyphidia;
acanthohyphidia and pseudoacanthohyphidia absent.

Type species: *Thelephora hirsuta* Willd.:Fr.

Distribution: Worldwide.

This subgenus contains the greatest number of species. Two informal sections can be recognized, based on the presence or absence of a distinct cutis. One section contains two species: *S. striatum* (Fr.:Fr.) Fr. and *S. ochraceo-flavum* (Schw.) Ell., both of which lack a well-defined cutis (Figs. 5 and 6). Mature pilei at the end of the season (especially in the south), or during a second season of growth, may show a pale yellow zone where the cutis would be. This layer is not morphologically distinct (compact) as in other *sterea*, and is far from being dark brown.

The tomentum is derived from the pale-colored context directly, giving the pileus surface a whitish appearance. If the tomentum is more or less appressed (Fig. 6), the pileus surface appears to be lineate-striate, shining and sericeous, as in S. striatum. If the tomentum is composed of erect hairs of conglutinate hyphae (Fig. 5), then the surface takes on a strigose-hirsute or hispid texture. This condition characterizes S. ochraceo-flavum.

The other section of Stereum subg. Stereum constitutes a group of species which displays much variation in gross morphology. All of these species possess a distinct cutis (Fig. 3). This section has been a taxonomically difficult group; as a result dozens of names have been proposed for the many variations in form. The other extreme, to lump all the species into a single taxon, the "S. hirsutum-complex", was suggested by Welden (1971). The intent behind such an action is appreciated, but the extreme position is unwarranted. S. gausapatum, for example, can be distinguished from other members of the "complex" on the bases of pseudocystidial wall thickness and substrate (Chamuris, 1985). For this reason all future reference to the S. hirsutum-complex excludes S. gausapatum.

In the temperate zone, one can usually distinguish S. complicatum (Fr.:Fr.) Fr. from S. hirsutum on gross morphological grounds. It is recognized, however, that such a separation is often not possible, especially when the basidiomata are young. As Welden suggested (1971), intermediate specimens are likely to be encountered, and placement in one of the three available species may be an arbitrary decision. But the existence of intermediate specimens does not necessarily negate the value of the groups themselves. In doubtful cases, assigning the specimen to the S. hirsutum-complex is a pragmatic, last-resort decision; the "complex" concept should be retained. When, however, the specimen in hand is clearly a "complicatum" or a "hirsutum", it is desirable to maintain the distinctions. Completely ignoring the differences may prejudice future ecological, mycelial interaction and forest pathological studies. A compromise situation would involve the use of (awkward?) phrases like "complicatum form of S. hirsutum". A summary of the principal characters used to separate S. hirsutum, S. complicatum and S. versicolor (Sw.:Fr.) Fr. is given in Table 2.

Key to North American Species
of *Stereum* subg. *Stereum*

Compact, brownish cutis absent; tomentum whitish

Tomentum of erect hairs; pileus surface soft, strigose-hirsute or hispid; on a variety of hardwoods (not known on *Carpinus* spp. or *Nyssa* spp.) *S. ochraceo-flavum* (= *S. sulphuratum*)

Tomentum of short appressed hairs; pileus surface lineate-striate, shining, sericeous; on *Carpinus* spp., rarely *Nyssa* spp. *S. striatum* (= *S. sericeum*)

Compact, brownish cutis present (ca. 50 μ m thick); tomentum with some shade of brown, yellow (gray when old)

Pseudocystidial walls less than 1.5 μ m thick; contents brownish; restricted to wood of *Quercus* spp. *S. gausapatum*

Pseudocystidial walls greater than 1.5 μ m thick; contents hyaline or yellowish, (may be brownish in tropics, *S. versicolor*); on a variety of hardwoods *S. hirsutum*-complex, sensu Chamuris (*S. hirsutum* = *S. styracifluum*, *S. complicatum*, *S. versicolor*) (See Table 2)

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MYCOTAXON

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OBSERVATIONS ON THAMNIDIACEAE (MUCORALES). III.
MYCOTYPHACEAE FAM. NOV. AND A RE-EVALUATION OF
MYCOTYPHA SENSU BENNY & BENJAMIN¹
ILLUSTRATED BY TWO NEW SPECIES¹

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SUMMARY

A new family, Mycotypaceae, is proposed for Benjaminiella and Mycotypha based on the ability of these fungi to produce a yeast-like phase and, especially, their unique mode of sporangium secession. This occurs through fracture of a circumscissile zone of weakness formed at the junction of the denticle and the pedicel. The genus Mycotypha, sensu Benny & Benjamin, is reassessed. Mycotypha poitrasii is referred to Benjaminiella, a genus characterized by globose fertile vesicles, monomorphic sporangia and denticles, and long pedicels. Mycotypha, characterized by cylindrical fertile vesicles, dimorphic sporangia and denticles, and short pedicels, is retained for M. africana and M. microspora. Two new species are introduced. Benjaminiella multispora is distinguished from B. poitrasii by its multispored sporangia. Mycotypha indica resembles M. microspora but is homothallic. Further, in M. indica, the sporangia borne

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in the outer row are obovoid whereas they are cylindrical in M. africana. Keys to the genera and species of the Mycotyphaceae are provided.

INTRODUCTION

Mycotypha was introduced (Fenner, 1932) for a single species, M. microspora Fenner, and placed in the tribe Cephalideae of the Mucoraceae according to the system of Gäumann (1928). Zycha (1935), and Naumov (1939) omitted Mycotypha from their respective treatments of the Mucorales and, while Bessey (1950) placed Mycotypha in the Choanephoraceae, Hesselstine (1952) referred it to the Cunninghamellaceae. This latter treatment was subsequently followed by many students of the Mucorales (Benjamin, 1959; Cole and Samson, 1979; Hesselstine, 1955; Hesselstine and Ellis, 1973; Mil'ko, 1967, 1974; Pidoplichko and Mil'ko, 1971), although Zycha and Siepmann (1969) included it in their relatively broad concept of the Choanephoraceae. Young (1969), however, clearly demonstrated that Mycotypha should be transferred to the Thamniaceae.

The inclusion of Mycotypha in the Mucorales was questioned (Wolf, 1957; Boedijn, 1958) until the zygomycetous affinities of the genus were confirmed with the description of a second species, M. africana Novak & Backus (1963), morphologically similar to M. microspora but forming zygospores.

Benny and Benjamin (1976) transferred Cokeromyces poitrasii R.K. Benjamin (1960) to Mycotypha because it showed closer affinities to M. microspora and M. africana than to the type species of Cokeromyces, C. recurvatus Poitras (Shanor et al. 1950). This treatment was accepted by other workers (Benjamin, 1979; Brain and Young, 1979; O'Donnell, 1979) although Pidoplichko and Mil'ko (1971) had earlier made C. poitrasii the type of Benjaminia Pidopl. & Mil'ko (non Ahmad, 1967) and placed that genus in the Cunninghamellaceae. Von Arx (1981) introduced Benjaminia von Arx for the illegitimate (Art. 64.1) Benjaminia Pidopl. & Mil'ko.

It is our premise that the characters employed by Benny and Benjamin (1976) to include C. poitrasii in Mycotypha (deciduous sporangiola, and vegetative and

colony characters, especially hyphal dimorphism), are indicative of relationships at the suprageneric level. The superficial differences between M. poitrasii (R.K. Benny & R.K. Benjamin) and the other two species of Mycotypha, M. africana and M. microspora, are augmented when it is considered that characters such as pedicel and sporangium dimorphism, ontogeny, and mechanism of secession in the two latter species are unique within the Mucorales.

The purpose of this paper is to clarify the systematic position of Mycotypha sensu Benny & Benjamin (1976), introduce two new species, and elucidate interspecific and intergeneric relationships.

MATERIALS AND METHODS

The source of specimens of the new species is given in the text. In addition cultures of the following fungi were examined as part of this study: Benjaminiella poitrasii (RSA 903; =ATCC 13844; =CBS 158.60; =IMI 81585; =NRRL 2845--culture derived from the holotype); Mycotypha microspora (RSA 1183; IMI 282443--FINLAND: Asikkala EH, Vähä-Äiniö, tract 26, near the shore of Lake Päijänne, ca. 30 km NNW of Lahti, on mouse dung, coll. Anni and Veikko Hotinen, June 2, 1979, isol. G.L. Benny); Mycotypha africana (RSA 1193; =ATCC 15344; =CBS 122.64; =IMI 139108; =NRRL 2978--culture derived from the holotype). Institutional designations are those of Holmgren et al. (1981). Holotype specimens have been deposited at IMI, and isotypes have been sent to NY, FLAS, RSA, BPI, K, and FH. Cultures derived from the holotype have been sent to ATCC, CBS, IMI, and NRRL (Northern Regional Research Center, Peoria, Illinois 61604, U.S.A.).

Descriptions of cultural characteristics, and vegetative and reproductive structures, are based on pure cultures grown on MEYE (malt extract-yeast extract agar, Benny and Benjamin, 1975; Mycotypha indica), or YpSs (Emerson's yeast extract-soluble starch agar, Difco; Benjaminiella multispora). Cultures were grown in an incubator at 26 C under a 12 hrs light/12 hrs dark cycle. Additional media used were: YpD (YpSs Agar (Difco) + 5 gm dextrose/liter), MSMA (Modified Synthetic Mucor Agar, Benny and Benjamin, 1975), LYE (Leonian's agar + 1 gm yeast extract/liter, Malloch and Cain, 1971), V8 (V-8

Juice agar, Miller, 1955), Whey (Whey agar, based upon Schipper, 1969;--powdered whey, 20 gm; dextrose, 10 gm; agar, 15 gm; distilled water, 1 liter), and PDA (Potato Dextrose Agar, Difco). Estimates of reproductive ability are measured from the highest (5+) to the lowest (1+) number of fruiting heads or zygosporoes produced.

Measurements and drawings were made according to the procedures of Benny and Benjamin (1975). Capitalized color names are those from Ridgway (1912).

The scanning electron micrograph of Benjaminiiella multispora in Fig. 4a was produced using the methods employed by Samson et al. (1979). Scanning electron micrographs of some zygosporoes (Figs. 4b, 5g, 6n) were made from cultures grown on MEYE agar at 26 C for 10-14 days, fixed at room temperature in one-half strength Karnovsky's fixative (Karnovsky, 1969) in 0.05 M cacodylate buffer (pH 7.2), washed in the buffer four times, post-fixed in 1% osmium tetroxide in 0.05 M cacodylate buffer (pH 7.2) overnight at 4 C, washed twice in the buffer and twice in distilled water, dehydrated in a graded (25%, 50%, 75%, 95%, 100%) ethanol series (15 min each change), and then held overnight in a second change of 100% ethanol. The material was then critical point dried in a Balzer's CPD010 drying apparatus. The remainder of the specimens observed by SEM were fixed in 1% osmium tetroxide vapors at room temperature for 96 hrs and then air dried according to the procedure of Quattlebaum and Carner (1980). All material, except Fig. 4a, was coated with gold in a Hummer Jr. sputter coater, and observed with a Hitachi S-450 scanning electron microscope.

TAXONOMY

Mycotyphaceae Benny & R.K Benjamin, fam. nov.

Sporophora e hyphis submersis oriunda, simplicia vel ramosa, in summo vesiculam fertilem sporangiolis pedicellatis, uni- vel multisporis, aequalibus vel dimorphis obtectam ferentia; stolones absentes. Sporangiola in zona praeformata liberata, denticulos truncatos in vesicula relinquentia. Sporangiosporae forma et magnitudine variabiles, oriunda e sporangiolis unisporis sporangiole simillima. Zygosporangia globosa vel subglobosa, projectionibus conicis obtecta, suspensores oppositi, appendicibus carentes. Species seu

homothallicae seu (verisimile) heterothallicae.

Genus typicum Mycotypha Fenner.

Sporophores arising directly from the submerged mycelium, simple or branched, stolons not produced; sporophores terminating in a fertile vesicle bearing pedicellate, unispored or multispored, monomorphic or dimorphic sporangiola. Sporangiola dehiscing by a circumscissile fracture at a preformed zone of weakness leaving monomorphic or dimorphic, truncate denticles on the fertile vesicle. Sporangiospores of various shapes and sizes; those from the unispored sporangiola of similar shape and size to the intact sporangium. Zygosporangia globose to subglobose; ornamented with more or less conical projections; suspensors opposed, non-appendaged. Homothallic, or presumably heterothallic.

Type genus: Mycotypha Fenner.

The ease in which the yeast-like budding phase is produced, and especially, the mode of sporangium dehiscence, separate species of Benjaminiella and Mycotypha from the other members of the Thamnidaceae, sensu Benny and Benjamin (1975, 1976). These characteristics are sufficiently distinct to warrant placing the two genera in a separate family.

Mycotypha is restricted to those taxa producing dimorphic sporangiola and denticles, and cylindrical fertile vesicles. Benjaminiella (von Arx, 1981) contains those species forming monomorphic sporangiola and denticles, and globose to obpyriform fertile vesicles. Several currently accepted genera in the Mucorales contain species that produce unispored and multispored sporangiola. These include Radiomyces (Ellis and Hesseltine, 1974), Mortierella (Gams, 1977), and Blakeslea (Thaxter, 1914; Mehrotra and Baijal, 1968; Kirk, 1984--the species of which usually form either all unispored or all multispored propagules), and Backusella (Benny and Benjamin, 1975--a genus where all of the species form unispored and multispored sporangiola simultaneously). Species of Benjaminiella and Mycotypha are readily distinguished by the shape of the fertile vesicle, the length of the pedicel, and whether the sporangiola and denticles are monomorphic or dimorphic (Fig. 1). The genera can be distinguished using the following key:

KEY TO THE GENERA OF MYCOTYPHACEAE

- A. Fertile vesicle globose to more or less ovoid; pedicels relatively long and twisted and contorted; sporangiola and denticles monomorphic.....Benjaminiella
- AA. Fertile vesicles cylindrical; pedicels relatively short, straight; sporangiola and denticles dimorphic.....Mycotypha

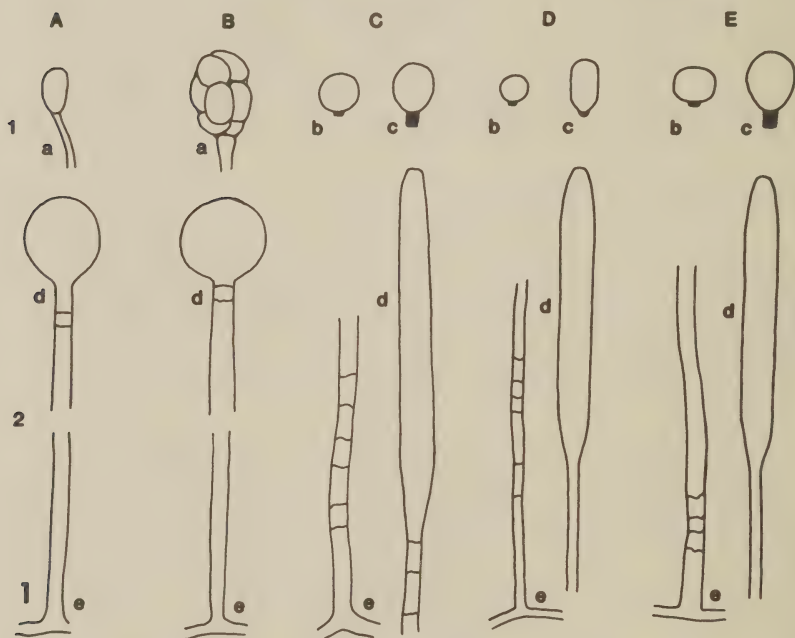


Fig. 1. Characteristics of the anamorph of species of Mycotyphaceae useful in identification. Legend: (1). Sporangiola. a. Monomorphic sporangiola. b, c. Dimorphic sporangiola. b. Globose sporangiola. c. Obovate or cylindrical sporangiola. (2). Fertile vesicle and base of sporophores. d. Fertile vesicle and apex of sporophore. e. Sporophore base. Note placement of septa in the sporophore. A) Benjaminiella poitrasii; B) B. multispora; C) Mycotypha microspora; D) M. africana; E) M. indica.

Benjaminiella multispora Benny, Samson & Srinivasan,
sp. nov. Figs. 1B, 2a-m, 3a-l, 4a-e.

Coloniae fere lente crescentes, exiguae, plus minusve zonatae, griseae. Sporophora simplicia, vulgo erecta, 1-3 mm alta, 6.5-7.5 μ m lata, primum hyalina, deinde dilute brunnea, raro septata, pariete asperulata; vesiculae et sporangiola velut capitula fere globosa 85-210 μ m diam apparent. Vesiculae fertiles leves, 14-33 μ m diam, obpyriformes ad quasi globosae, undique sporangiola pedicellata proferentes; pedicelli sporangiorum longitudine variabilia (10-150 μ m), 1-1.5 μ m lata, fere recta vel recurvata vel contorta, decidua, post secessionem denticulos plus minusve conicos, truncatos, 1.5-2.0 x 1.5 μ m, relinquentia. Sporangiola 2-9 sporas continentia, cylindrica vel obovoidea, (10-)12-14(-15) x (5-)6-6.5(-7.5), plerumque 12.5 x 6 μ m, levia, cito a pedicello separata; columellae plus minusve turbinatae, saepe sursum concavae, 1.5-3 μ m diam, leves. Sporangiosporae leves, tenuitunicatae, plus minusve globosae vel late ellipsoideae vel forma irregulares, (3-)3.5-4(-6) x (2.5-)3-4(-4.5), plerumque 3.7 x 3.2 μ m. Hyphae submersae vulgo in cellulas hyalinas, globosas, zymoideas transeuntes usque ad 30 μ m diam proferentes. Zygosporae formatae inter sporophoras, zygophoras, aut sporophoras et zygophoras, ad praecipue in superficie substrati, singulae vel paulae aggregatae, globosae vel subglobosae, (49-)57-74(-80), in medio 66 μ m diam (projectionibus inclusis), pariete fusco projectionibus conicis, 2.5-6.5 μ m altis obtecta; suspensores oppositi, inaequales, leves, hyalini vel dilute brunnei. Species homothallica.

Holotypus IMI 234109, isotypus CBS 421.70, isolatus e terra humosa prope Poona in India, Feb. 1969, a M.C. Srinivasan.

Colonies on MEYE 7-7.5 cm diam in 12-14 days at 26 C, turf sparse, more or less zonate, Mouse Gray to Deep Mouse Gray, becoming near Light Drab in age. Sporophores simple, more or less erect, up to 1-3 mm high, 6.5-7.5 μ m diam, hyaline at first, becoming light brown, sparsely septate in age; wall roughened; fertile vesicle and sporangiola forming more or less globose heads 85-210 μ m diam. Fertile vesicles smooth, 14-33 μ m diam, obpyriform to more or less globose, bearing pedicellate sporangiola over their entire surface. Pedicels bearing sporangiola

variable in length, 10-150 μm long, 1-1.5 μm in diam, more or less straight to recurved or strongly twisted and contorted; deciduous, with the base more or less the same diam as the pedicel above the abscission zone; pedicel base after dehiscence forming a more or less conical, truncate denticle, 1.5-2 μm high, 1.5 μm wide at the base. Sporangiola multispored, usually containing 2-9 sporangiospores, cylindrical to obovoid, (10-)12-14(-15) x (5-)6-6.5(-7.5), av. 12.5 x 6 μm , smooth, readily separating from the pedicel; columella more or less turbinate, often with a concave apex, 1.5-3 μm diam, smooth. Sporangiospores smooth, thin-walled, more or less globose to broadly ellipsoid or irregular, (3-)3.5-4(-6) x (2.5-)3-4(-4.5), av. 3.7 x 3.2 μm . Substrate hyphae at first non-septate, becoming irregularly septate in age; giving rise to hyaline, globose, yeast-like budding cells up to 30 μm diam. Zygospores formed aurally between zygomorphs, sporophores, or zygomorphs and sporophores, at all levels above the agar surface either singly or in small groups; globose to subglobose, (49-)57-74(-80), av. 66 μm diam including projections; wall dark brown, covered with more or less conical projections, 2.5-6.5 μm high; suspensors opposed, anisogamous, smooth, hyaline to light brown. Homothallic.

HOLOTYPE.--INDIA: Maharashtra State, Poona, humus rich soil, February, 1969, iso. M.C. Srinivasan (IMI 234109--Holotype;=CBS 421.70--Isotype).

ETYMOLOGY.--from multi (L.), many, and spora (L.), spore, referring to the many spored sporangium.

DISTRIBUTION.--India; known only from the type locality.

NOTES.--Benjaminiella multispora produces unbranched sporophores (Figs. 1Bd-e, 2a) which bear a single apical fertile vesicle (Figs. 1Bd, 2a,b, 3d) and may form a zygospore (Fig. 2a) at a random point along its length. The fertile vesicles (Figs. 1Bd, 2b, 3d) are obpyriform to more or less globose and produce pedicels over their entire surface, forming a more or less globose fruiting head (Figs. 2b, 3a). The pedicels are relatively long, recurved to twisted and contorted (Figs. 2b-d, 3b) and are more or less of constant diameter over most of their length. The pedicel, which is not swollen basally, detaches at a proximal circumscissile zone of weakness (Figs. 2f,i, 3g-i) leaving a truncate denticle (Figs. 2e,

3l, 4a) on the fertile vesicle. Distally the pedicellar apex forms a columella (Figs. 2g,h, 3c) which is produced at the base of a multispored sporangiolium (Figs. 1Ba, 2c,d, 3b,c,j,k). The sporangiospores (Figs. 2j, 3e) are hyaline, smooth walled, and irregular in shape. Zygosporangia (Figs. 2k, 4b-d) are formed between opposed, non-appendaged suspensors, and they contain a single, thick walled and roughened zygosporangium (Figs. 2l, 4e). Yeast-like budding cells (Figs. 2m, 3f), which are formed in or on the agar, are relatively thick walled.

The isolate of Benjaminiella multispora studied here, like that of B. poitrasii, sporulates well on MSMA, although it is more prolific when growing on YpSs than it is on MEYE. Optimal (5+) sporulation has been observed on V8 and YpSs, it is excellent (4+) on YpD, good (3+) on LYE and Whey, but poor (2+) on MEYE and PDA. Zygosporangium formation is excellent (4+) on LYE, good (3+) on YpD, Whey, V8, and YpSs, and poor (1+) on MEYE and PDA. Benjaminiella multispora produces a sectorized or highly zonate colony that is off-white where sporulation does not occur. There is no pigment released into the agar.

Benjaminiella poitrasii (R.K. Benjamin) von Arx, "The Genera of Fungi Sporulating in Pure Culture," 3rd Ed., p. 60, 1981. Figs. 1A, 5a-k.
 =Cokeromyces poitrasii R.K. Benjamin, Aliso 4: 523. 1960.
 =Benjaminia poitrasii (R.K. Benjamin) Pidopl. & Mil'ko, "Atlas of Mucoralean Fungi," Acad. Sci. Ukran. S.S.R., Kiev, p. 96, 1971.
 =Mycotypha poitrasii (R.K. Benjamin) Benny & R.K. Benjamin, Aliso 8: 409. 1976.

Descriptions and illustrations of B. poitrasii are presented by Benjamin (1960), Zycha and Siepmann (1969)(both as Cokeromyces poitrasii), and Benny and Benjamin (1976)(as Mycotypha poitrasii). Additional figures are presented by Cole and Samson (1979), Brain and Young (1979), and O'Donnell (1979).

Benjaminiella poitrasii (Figs. 1A, 5a-k) produces sporophores (Figs. 1Ad-e, 5a) that consist of globose to obpyriform fertile vesicles (Figs. 1Ad, 5b), and pedicels of various lengths, each with a basal swelling (Fig. 5j), and have a single unispored sporangiolium apically (Fig.

1Aa, 5c,k). Only a single type of denticle is formed on the fertile vesicle (Fig. 5i). The zygosporangium is translucent, brown and covered with coarse, conical projections (Fig. 5d,g,h), has smooth walled opposed suspensors and contains a single, smooth walled zygosporangium (Fig. 5e). The yeast-like budding cells are relatively thin walled (Fig. 5f).

The two species of Benjaminiella (Figs. 1A,B, 2a-m, 3a-l, 4a-e, 5a-k) can be distinguished by: (1) the number of spores in the sporangium; (2) the presence or absence

pedicels.--c,d. Two multisporous sporangia. Note the variable length of the pedicels which are of a relatively constant diameter through their entire length except at the apex (immediately below the columella).--e. Optical section through a fertile vesicle showing three denticles after pedicel secession.--f. An optical section through a fertile vesicle showing two pedicel bases and subtending denticles. Note the constriction at the junction of the denticle and pedicel, the location of the circumscissile zone of weakness.--g. Pedicel apex showing columella after sporangium has been removed.--h. Pedicel apex showing columella and sporangium wall, but no spores.--i. Pedicel base.--j. Several sporangiospores showing variation in size and shape.--k. Zygosporangium showing ornamentation and both suspensors.--l. Zygosporangium showing the rough wall and large eccentric globule.--m. Three typical yeast-like budding cells.--n-v. Mycotypha indica.--n. Habit sketches of sporophores (stalk length not to scale).--o. Septate basal portion of a sporophore.--p. Aseptate upper portion of sporophore and elongate fertile vesicle bearing sporangia.--q. Subglobose and obovoid sporangia.--r. Lateral view of fertile vesicle showing two rows of sporangia, the outer composed of obovoid sporangia on longer denticles and the inner layer of globose sporangia subtended by short denticles.--s. Sporangia viewed from above showing the outer obovoid sporangia (darkly stippled) and inner subglobose sporangia (lightly stippled).--t. Zygosporangium showing ornamentation and two suspensors.--u. Zygosporangium showing conical ornamentation and large, eccentric globule.--v. Three relatively thick walled yeast-like budding cells. Mags.: a,n, X47; b,k,o,p,t, X470; c-j,q-s, X1,225; l,m,u,v, X520.

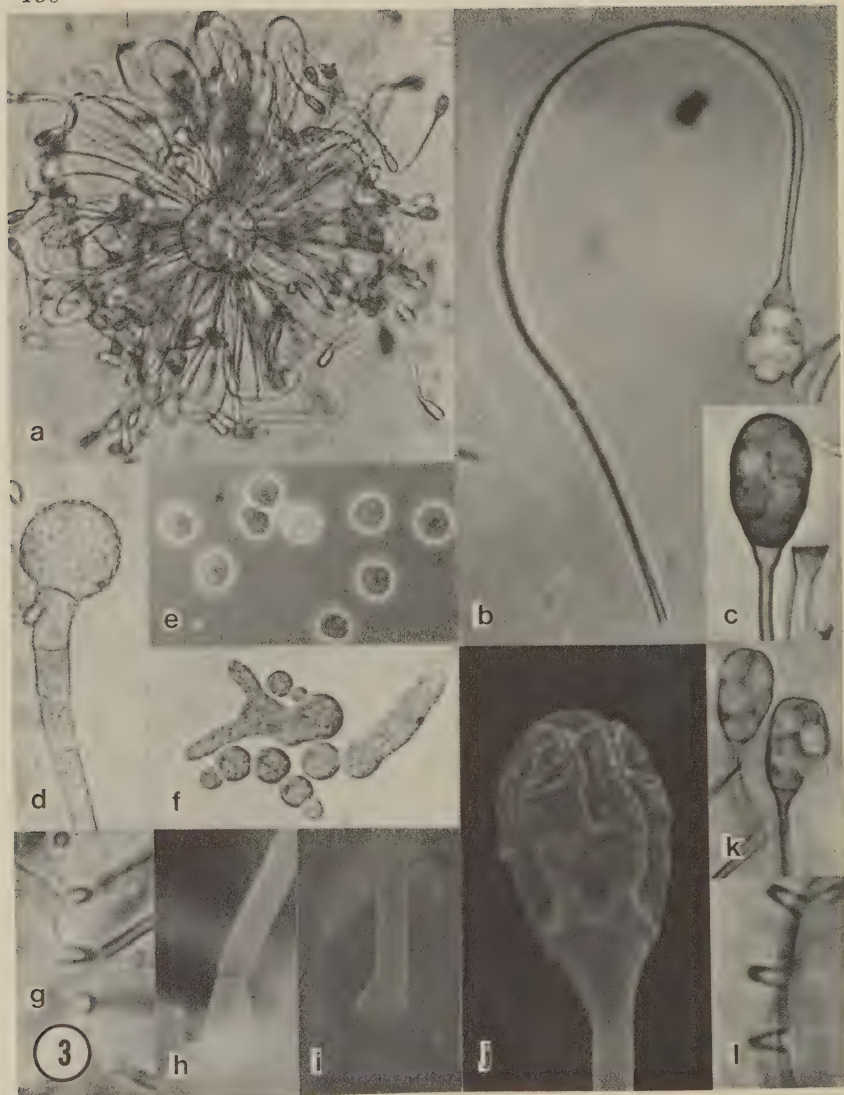


Fig. 3a-l. *Benjaminiella multispora* (CBS 421.70).--a-d, f, g, k, l. Light microscopy.--e. Phase contrast.--h-j. SEM.--a. Fruiting head.--b. Multispored sporangium on long pedicel.--c. Enlarged view of the apices of two pedicels, on one the sporangium has been released revealing the columella, the sporangium remains on the other.--d. Fertile vesicle after dehiscence.--e. Several sporangiospores--f. Several yeast-like budding cells, some

of sporophore branching; and (3) whether zygospores are formed aerielly or immediately above the agar surface. They can be separated by use of the following key:

KEY TO THE SPECIES OF BENJAMINIELLA

- A. Sporangiola unispored; some sporophores branched; zygospores formed near the surface of the substrate.....B. poitrasii
 AA. Sporangiola multispored; sporophores unbranched; zygospores usually formed above the substrate surface, in the aerial hyphae.....B. multispora

Mycotypha indica P.M. Kirk & Benny, sp. nov.

Figs. 1E, 2n-v, 6a-n

Coloniae fere lente crescentes, dense lanosae, plus minusve zonatae, griseae. Sporophora primum simplicia, sed subinde saepe ramulos gerentia, plus minusve erecta, ad 3-4 mm alta, (4-)6-9(-12) μ m lata; primum hyalina, deinde grisescentia et in parte proxima multiseptata, pariete exigue asperulata, praecipue in parte distali. Vesiculae fertiles longitudine variabiles, ovideae vel clavatae, sed plerumque plus minusve cylindricae, parce asperulatae, (15-)150-300(-500) μ m longae, (12-)16-24(-32) μ m diam (sporangioliis exclusis), sursum rotundatae, undique (summo apice excluso) sporangioliis oblecta. Sporangiola in duobus stratis disposita, dimorpha: sporangiola strati exterioris late ellipsoidea vel obovoidea, 4-6.5 x 3-4.5 μ m, plerumque 4.8 x 3.7 μ m, dilute columbina, levia, pedicellis plus minusve conicis, ca. 2 x 1.5 μ m, ad 0.5 μ m angustatis supportata, liberata vestigium pedicelli ca. 1

germinating to produce hyphae.--g. Portion of fertile vesicle showing pedicel dehiscence.--h,i. Pedicel base and subtending denticle. Note that the pedicel base is not swollen.--h. Lateral view.--i. Oblique view.--j. A sporangiolium.--k. Two sporangiola. Note that the sporangiolium wall of one has broken and a sporangiospore is being released.--l. Margin of fertile vesicle showing three denticles after dehiscence. Mags.: a, X305; b,k, X1,375; c, X1,910; d, f, X475; e, X1,145; g,l, X2,225; h-j, X5,400.

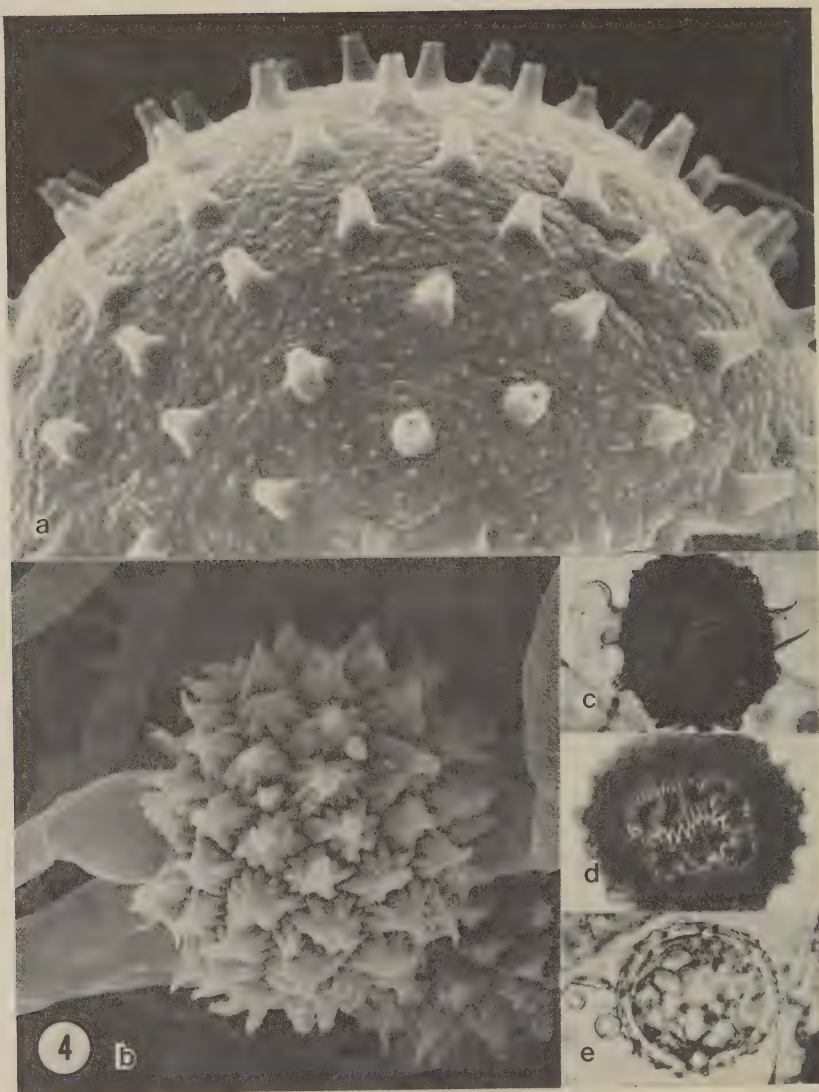


Fig. 4a-e. *Benjaminiella multispora* (CBS 421.70).--a, b. SEM.--c-e. Light microscopy.--a. Portion of fertile vesicle after dehiscence showing morphology and arrangement of denticles.--b. Zygosporangium showing ornamentation and opposed suspensors.--c. Zygosporangium showing opposed suspensors.--d. Surface view of zygosporangium showing ornamentation.--e. Optical

μm longum ferentia; sporangiola strati interioris globosa ad subglobosa, 3-4, in medio $3.6 \mu\text{m}$ diam, dilute columbina, levia, pedicellis ca. $1 \mu\text{m}$ longis, conicis supportata, liberata vestigium pedicelli ca. $0.5 \mu\text{m}$ longum ferentia. Vestigia pedicellorum amborum stratorum denticulos conicos $0.5-1 \mu\text{m}$ longos in vesicula relinquentia. Sporangiola unispora. Hyphae submersae vulgo in cellulas hyalinas, globosas, zymoideas transeuntes usque ad $50 \mu\text{m}$ diam proferentes; interdum veterum cellularum chlamydosporas tenuitunicatas formantes. Zygosporae copiosae, in hyphis aeriis vel ad superficiem substrati formatae, globosae vel subglobosae, (45-)65-80(-90), plerumque $72 \mu\text{m}$ diam (projectionibus inclusis), pariete fusco, projectionibus conicis ad $10 \mu\text{m}$ vel magis altis oblecta; suspensores oppositi, inaequales, leves, hyalini vel diluti grisei vel atrobrunnei. Species homothallica.

Holotypus IMI 211999, isotypus CBS 245.84, isolatus ex terra prope Jabalpur in India, Mar. 1977, a D.N. Tiwari (N 40).

Colonies on MEYE 4-5 cm diam in 12-14 days at 26°C ; turf dense, more or less zonate, near Mouse Gray, becoming Light Drab to Drab in age. Sporophores simple at first, often secondarily branched; more or less erect, up to 3-4 mm high, (4-)6-9(-12) μm diam; hyaline at first, becoming pale bluish gray, grayish brown in age; non-septate distally below the fertile vesicle; becoming irregularly multiseptate proximally; wall minutely roughened, especially distally, thicker proximally. Fertile vesicle variable in length, ovoid to clavate, but mostly short- to long-cylindrical; minutely roughened; (15-)150-300(-500) μm long, (12-)16-24(-32) μm diam without sporangiola; rounded at the apex; bearing sporangiola over the entire surface except at the extreme tip. Sporangiola dimorphic, forming two distinct layers over the surface of the fertile vesicle: (1) Sporangiola comprising the outer layer broadly ellipsoid to obovoid, $4-6.5 \times 3-4.5$, av. $4.8 \times 3.7 \mu\text{m}$, pale bluish gray, smooth, borne on more or less conical pedicels ca. $2 \mu\text{m}$ long, $1.5 \mu\text{m}$ wide at the base, ca. $0.5 \mu\text{m}$ wide above; after secession, sporangium

section through zygospore. Mags.: a, X 4,200; b, X1,230; c-e, X505.

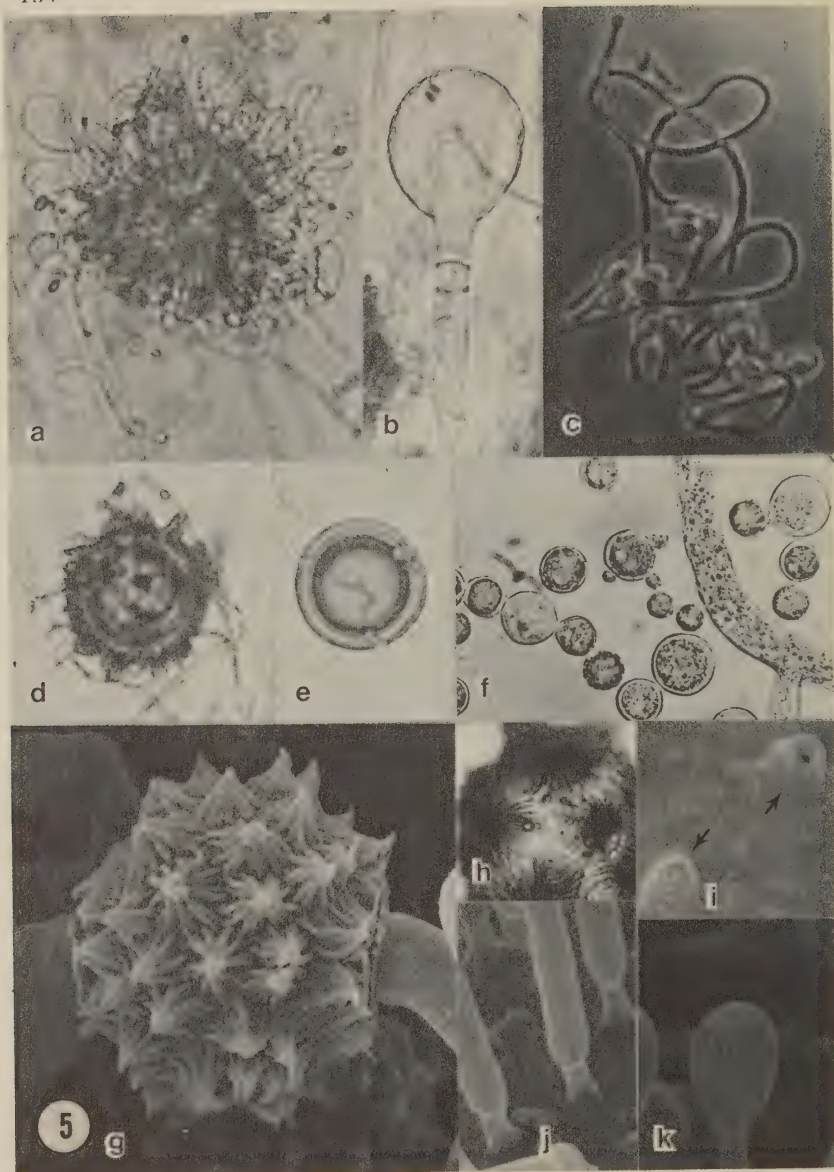


Fig. 5 a-k. *Benjaminiella poitrasii* (RSA 903).--a, b, d-f, h. Light microscopy.--c. Phase contrast.--g, i-k. SEM.--a. Fruiting head.--b. Fertile vesicle after dehiscence.--c. Several sporangia, some on relatively short and curved pedicels, others on long, twisted and contorted pedicels

bearing remnant of pedicel ca. 1 μ m long; pedicellar base forming a conical, truncate to rounded denticle ca. 1 μ m high on the fertile vesicle. (2) Sporangiola comprising inner layer globose to subglobose, 3-4, av. 3.6 μ m diam, pale bluish gray, smooth, borne on short, conical pedicels ca. 1 μ m or less high, ca. 1 μ m wide at the base; after secession, sporangium bearing remnant of pedicel ca. <0.5 μ m long; pedicellar base forming an inconspicuous, truncate denticle ca. <0.5 μ m high on the fertile vesicle. Sporangiospores of similar size and shape to the sporangiola. Substrate hyphae branched, non-septate at first, becoming irregularly septate; giving rise to hyaline, globose, yeast-like budding cells up to 50 μ m diam, occasional cell segments forming relatively thin-walled chlamydospores. Zygospores abundant, formed on aerial hyphae near surface of substrate; globose to subglobose, (45-)65-80(-90), av. 72 μ m diam including projections; wall brownish black to black, covered with coarse, conical projections up to 10 μ m or more high; suspensors opposed, anisogamous, smooth, hyaline to pale gray or blackish-brown. Homothallic.

HOLOTYPE.--INDIA: Madhya Pradesh, Jabalpur, soil, March, 1977, D.N. Tiwari (N 40)(IMI 211999--Holotype; CBS 245.84 --Isotype).

ETYMOLOGY.--from indica (L.), referring to India, the country of origin.

DISTRIBUTION.--India; known only from the type locality.

OTHER SPECIMEN EXAMINED.--INDIA: Madhya Pradesh, Jabalpur, Jabalpur Botanic Gardens, Bambusa leaf litter, January 1984, N. Singh (NS/32)(IMI 287391).

NOTES.--Mycotypha indica produces unbranched sporophores

--d. Zygosporangium and suspensors.--e. Zygospore showing smooth wall.--f. Vegetative hyphae and yeast-like budding cells from colony surface.--g. Zygosporangium showing ornamentation and opposed suspensors.--h. Zygosporangium surface showing ornamentation.--i. Portion of fertile vesicle showing two denticles (arrows) after dehiscence.--j. Oblique view of three pedicel bases and their subtending denticles. Note that each pedicel base is swollen.--k. Lateral view of young sporangium. Mags.: a,b,d-f,h, X500; c, X1,200; g, X1,220; i-k, X5,775.

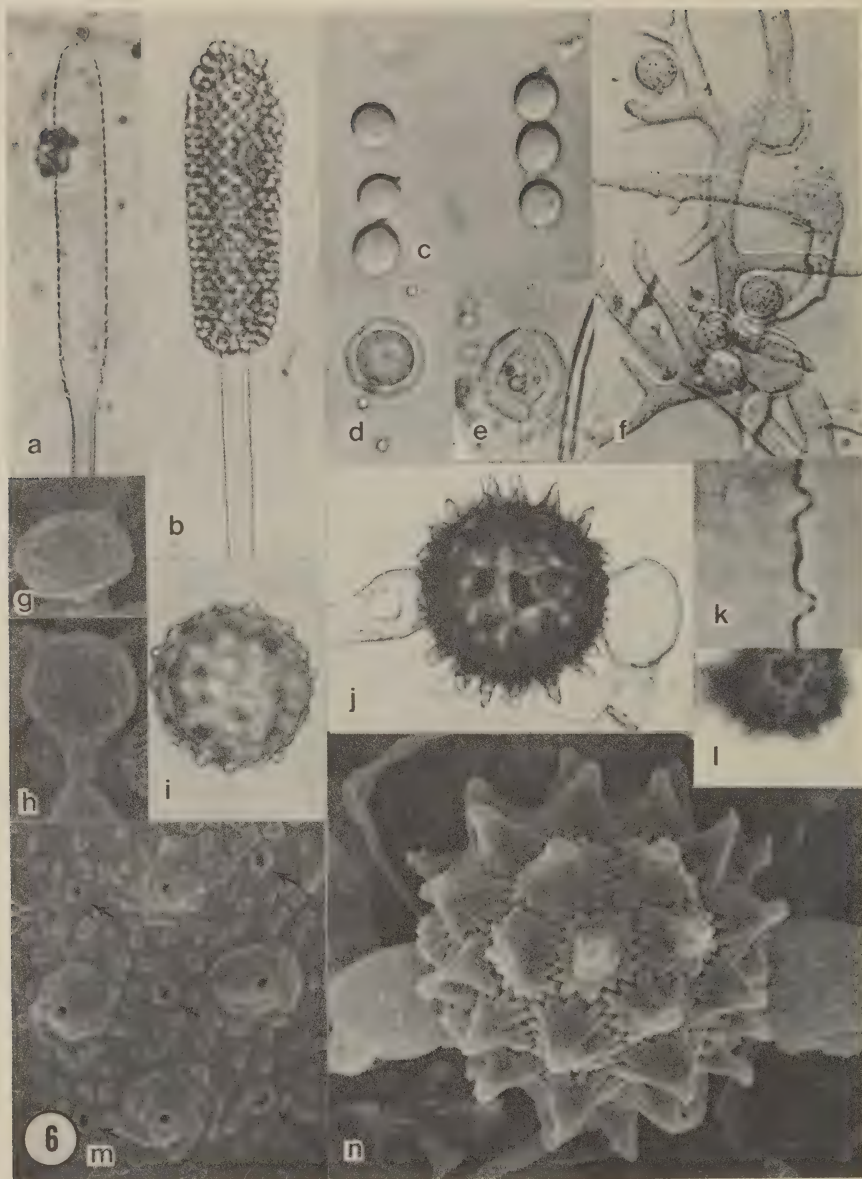


Fig. 6 a-n. *Mycotypha indica* (IMI 211999).--a, b, d-f, i-l. Light microscopy.--c. Nomarski Interference Phase Contrast.--g, h, m, n. SEM. --a. Fertile vesicle after sporangium dehiscence.--b. Fertile vesicle before sporangium dehiscence.--c. Dimorphic sporangiola.--d. Thick walled yeast-like budding cell.--e. Thick walled yeast-like budding cell after germination.--f. Vegetative

(Fig. 2n) with basal septa (Fig. 1Ee, 2o) that bear a single apical, cylindrical fertile vesicle (Figs. 1Ed, 2p, 6a,b), and zygosporoes near the surface of the substratum (Fig. 2n). The sporangiola are unispored, dimorphic (Figs. 1Eb-c, 2q,r, 6c,g,h), and since they are formed on dimorphic denticles (Fig. 6g,h,k,m) they are arranged in two layers (Fig. 2r,s). Zygosporangia (Figs. 2t, 6j,l,n) are formed between opposed, non-appendaged suspensors and they contain a single relatively thick walled, coarsely ornamented zygosporoe (Figs. 2u, 6i). Yeast-like budding cells (Figs. 2v, 6d-f) are formed in and on the agar, and they can be relatively thick walled (Fig. 6d,e).

Mycotypha indica, like M. microspora and M. africana, sporulates poorly on MSMA, although there is extensive growth of subaerial hyphae. Sporophore and sporangium formation is excellent (4+) on LYE and Whey agars, good (3+) on MEYE, V8, and YpSs agar media, but poor (1+) on YpD and PDA. Zygosporoe formation is optimal (5+) on YpD, excellent (4+) on V8, and good (3+) on LYE, MEYE, and Whey, with some (2+) zygosporoes being formed on YpSs and PDA. There is a tendency for the isolate of M. indica studied to sector, not form the anamorph which leaves the zygosporoes exposed, and thus produce a dark blackish-brown colony. The colonies are slightly zonate when the anamorph is produced but zonation is lacking when only the zygosporoes are formed. A brownish pigment is released

hyphae and yeast-like budding cells. Note yeast-like cells are still relatively thin walled.--g, h. Dimorphic sporangiola.--g. Sporangium from inner row of spores on a short denticle. Note that this is the globose sporangium figured in 6c.--h. Sporangium from outer row of spores on a long denticle. Note that this is the obovate sporangium figured in 6c.--i. Zygosporoe covered with conical ornaments.--j. Zygosporangium showing suspensors.--k. Optical section through fertile vesicle showing two denticles which subtend the outer row of sporangiola.--l. Surface view of a zygosporangium showing ornamentation.--m. Surface view of fertile vesicle showing arrangement of small (arrows) and larger denticles.--n. Zygosporangium showing ornamentation and opposed suspensors. Mags.: a,b, d-f, i,j,l, X470; c, X1,350; g,h,m, X5,400; k, X2,185; n, X1,145.

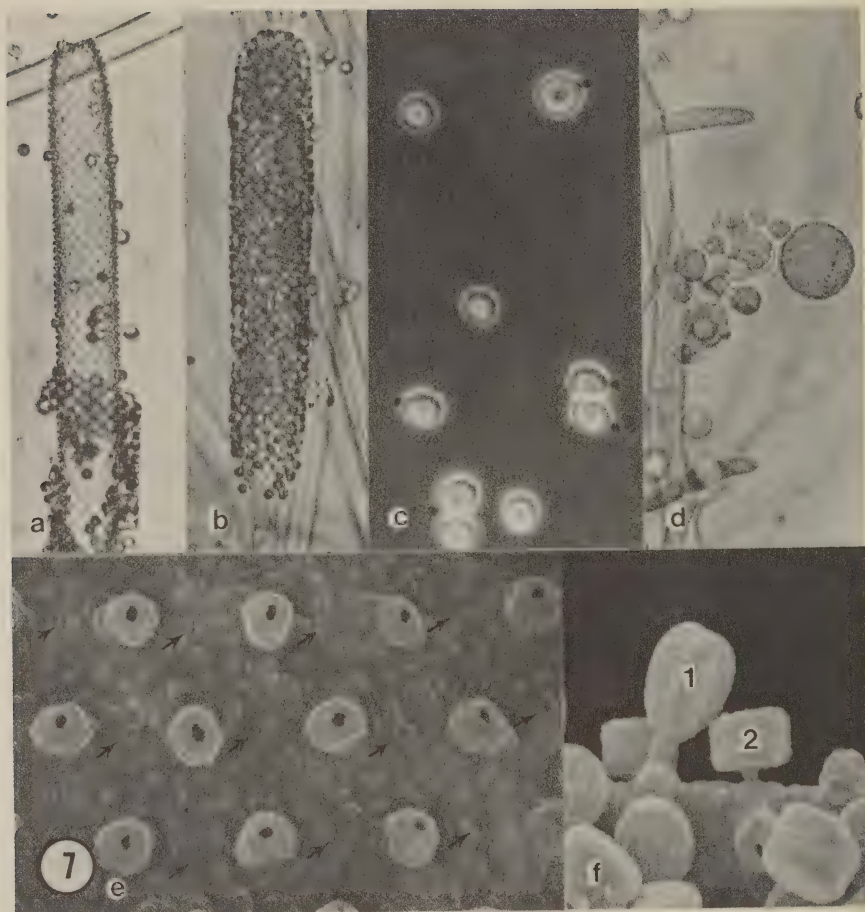


Fig. 7a-f. *M. microspora* (a,c, RSA 1183; b,d-f, IMI 282443).--a, b, d. Light microscopy.--c. Phase contrast.--e, f. SEM.--a. Fertile vesicle after sporangium dehiscence.--b. Fertile vesicle before sporangium dehiscence.--c. Dimorphic sporangia.--d. Vegetative hyphae and yeast-like budding cells.--e. Small (arrows) and large denticles on the surface of the fertile vesicle as viewed from above.--f. Lateral view of dimorphic sporangia and denticels. Note the obovoid sporangium (1) is on the larger denticle and the rectangular (globose when mounted in KOH-Phloxine; compare with Fig. 6c) sporangium (2) is on the smaller denticle. Mags.: a,b,d, X475; c, X1,145; e,f, X5,400.

into the agar when M. indica is grown on MEYE at 26 C under a 12 hrs dark/12 hrs light cycle.

Mycotypha microspora Fenner, Mycologia 24: 196. 1932.

Figs. 1C, 7a-f, 9A-D.

≡Microtypha microspora (Fenner) Monte, Oddo & Tonolo , Ann. Ist. Super. Sanità 3: 737. 1967.

Descriptions and illustrations of M. microspora are presented by Fenner (1932), and Benny and Benjamin (1976). Additional figures can be found in Young (1969), and Cole and Samson (1979). Mycotypha microspora (Figs. 1C, 7a-f, 9) produces a cylindrical fertile vesicle (Fig. 1Cd, 7a), and septa both at the apex and base of the sporophore (Figs. 1Cd-e). The fertile vesicle at maturity and before dehiscence, is completely covered with sporangiola (Fig. 7b). The sporangiola (Figs. 1Cb-c, 7c,f, 9) are dimorphic, with both obovoid and globose types being produced on dimorphic denticles (Fig. 7e,f). The yeast-like budding cells (Fig. 7d) are thin walled. Zygosporangium production in this species is unknown (Benny and Benjamin (1976).

Mycotypha africana Novak & Backus, Mycologia 55:

793. 1963.

Figs 1D, 8a-j.

≡Microtypha africana (Novak & Backus) Monte, Oddo & Tonolo, Ann. Ist. Super. Sanità 3: 737. 1967; as "(Backus & Novack)."

Descriptions and illustrations of M. africana are presented by Novak and Backus (1963), and Benny and Benjamin (1976). Additional figures of this taxon can be found in Young (1969), Brain and Young (1969), Cole and Samson (1979), and O'Donnell (1979). Mycotypha africana (Figs. 1D, 8a-j) produces a cylindrical fertile vesicle (Figs. 1Dd, 8a), and septa in the sporophore base (Fig. 1De). The fertile vesicle at maturity and before dehiscence, is completely covered with sporangiola (Fig. 8b). The sporangiola are dimorphic, some are cylindrical while the others are globose (Figs. 1Db-c, 8c,g) and are produced on dimorphic denticles (Fig. 8g,i). Thin walled yeast-like budding cells are readily formed by the submerged vegetative hyphae (Fig. 8d). The zygosporangia are dark and rough walled, and are formed between short, smooth, opposed suspensors (Fig. 8e,h,j). The zygosporangia have a hyaline, relatively thin, sculptured wall bearing

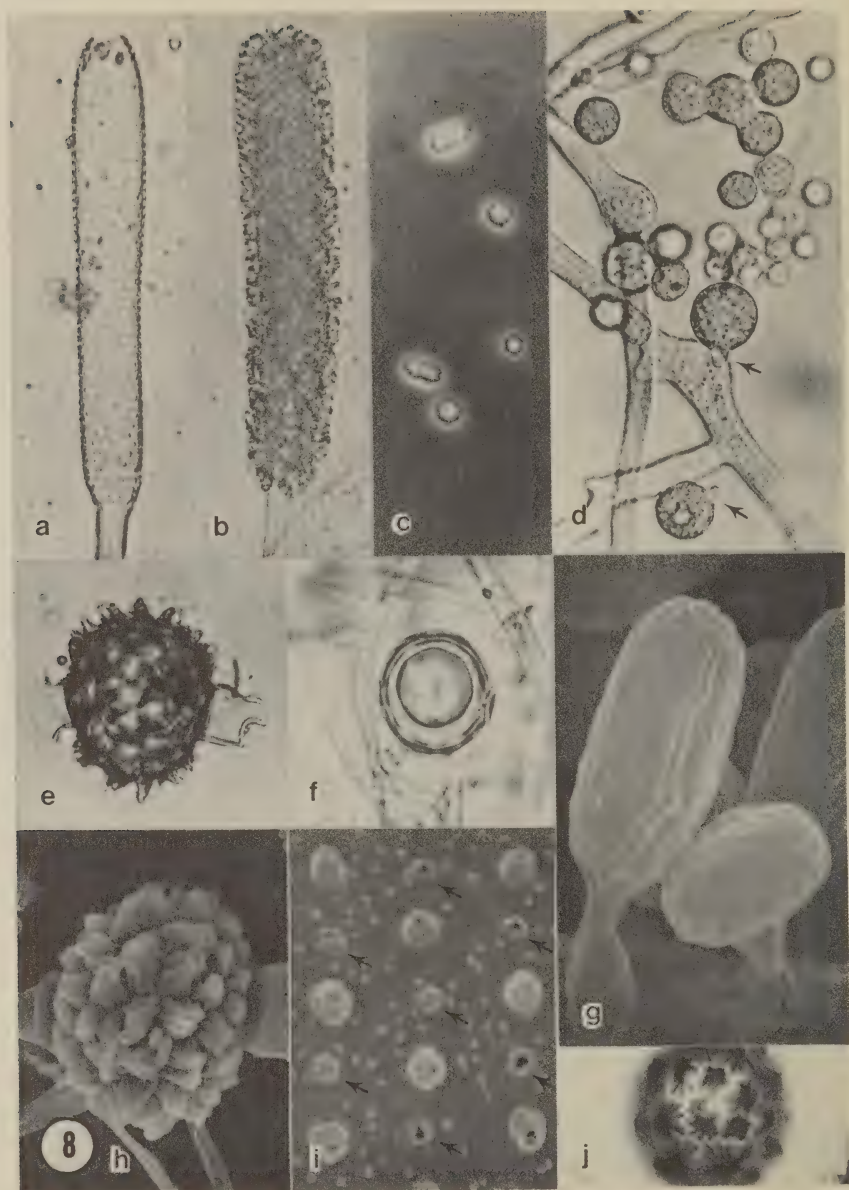


Fig. 8a-j. *Mycotypha africana* (RSA 1193).--a, b, d-f, j. Light microscopy.--c. Phase contrast.--g-i. SEM.--a. Fertilized vesicle after sporangium dehiscence.--b. Fertilized vesicle after sporangium dehiscence.--c. Fertilized vesicle after sporangium dehiscence.--d. Fertilized vesicle after sporangium dehiscence.--e. Fertilized vesicle after sporangium dehiscence.--f. Fertilized vesicle after sporangium dehiscence.--g. Fertilized vesicle after sporangium dehiscence.--h. Fertilized vesicle after sporangium dehiscence.--i. Fertilized vesicle after sporangium dehiscence.--j. Fertilized vesicle after sporangium dehiscence.

suspensor remnants, and contain a single eccentric globule (Fig. 8f).

Mycotypha indica (Figs. 2n-v, 6a-n) can be readily distinguished from the two previously known species, M. microspora (Fig. 7a-f) and M. africana (Fig. 8a-j), because of differences in the shape of the external sporangiola, the location of adventitious septa in the sporophore, and the presence or absence of zygosporos. The morphology of the external sporangiola readily distinguishes Mycotypha indica (sporangiola broadly ellipsoid to ovoid) from M. africana (sporangiola cylindrical with rounded ends). The position of sporophore septa and presence of zygosporos distinguish M. indica (septata at sporophore base; zygosporos formed, homothallic) from M. microspora (septata usually near sporophore apex, but sometimes formed basally; zygosporos unknown, presumably heterothallic). They can be separated by use of the following key:

KEY TO THE SPECIES OF MYCOTYPHA

- A. Sporangiola in outer row cylindrical....M. africana
- AA. Sporangiola in outer row broadly ellipsoid to ovoid or obovoid.....B
- B. Septa produced near the base of the sporophore; homothallic.....M. indica
- BB. Septa usually produced near apex but some may be formed near base; zygosporos unknown, presumably heterothallic.....M. microspora

vesicle before sporangiolium dehiscence.--c. Dimorphic sporangiola.--d. Vegetative hyphae and yeast-like budding cells. Note that two yeast-like cells are germinating (arrows).--e. Zygosporangium showing suspensors.--f. Zygosporos containing a single eccentric globule. Note gametangial remnants.--g. Dimorphic sporangiola and denticles.--h. Zygosporangium showing ornamentation and opposed suspensors.--i. Portion of fertile vesicle showing small (arrows) and larger denticles as viewed from above. Note arrangement of denticles.--j. Surface view of a zygosporangium showing ornamentation. Mags.: a,b, d-f, j, X490; c, X1,175; g, X11,990; h, X1,200; i, X5,560.

DISCUSSION

The dehiscence mechanism of the sporangiola in species of Benjaminiella and Mycotypha (Khan and Talbot (1975) may be unique in the Mucorales. They produce a circumscissile zone of weakness in the pedicel at a predetermined point and it is this zone of weakness which is responsible for the mechanism of sporangium secession. The location of this zone is readily observed as a slightly constricted area at the junction of the narrowest portion of the denticle and the base of the pedicel in carbon replicas or silhouettes observed by TEM (Young, 1969; in M. microspora and M. africana), SEM (Cole and Samson, 1979; Brain and Young, 1979; O'Donnell, 1979; in M. africana, M. microspora, and B. poitrasii), ultrathin sections or freeze fractures observed with TEM (Cole and Samson, 1979; in M. microspora). The constriction at the base of the pedicel has also been observed during the investigations reported here (Figs. 2f, 3h, 5j, 6g,h, 7f, 8g). In Mycotypha microspora (Fig. 9A-D) this condition is the result of the formation of two wall layers in the denticle, the outer of which terminates at the abscission zone, while the inner layer is continuous with the sporangial wall (Khan and Talbot, 1975; Brain and Young, 1979; Higham, 1980). In members of the Thamniaceae sporangium dehiscence is via one of two mechanisms: (1) rupture of the sporangium wall and subsequent release of the sporangiospore(s), or (2) fracture of the subtending pedicel which liberates the sporangium and the enclosed spore(s) as a single unit (Benny and Benjamin, 1975, 1976). A third method has been observed by one of us (GLB). In Thamnidium elegans Link, a circumscissile fracture occurs in the sporangium wall at its junction with the base of the columella, the pedicel and columella remaining intact following secession.

A second characteristic, common to all five species of Benjaminiella and Mycotypha, is their ability to form a yeast-like budding phase (hyphal dimorphism), on the surface of a variety of ordinary, solid, laboratory media. Hyphal dimorphism in spp. of Mycotypha has been discussed several times in recent years (Price et al., 1973; Schulz et al., 1974; Hall and Kolankaya, 1974). Cole et al. (1980) determined that the changes in morphology of the vegetative hyphae correlated with differences in wall chemistry. All of the above workers induced the

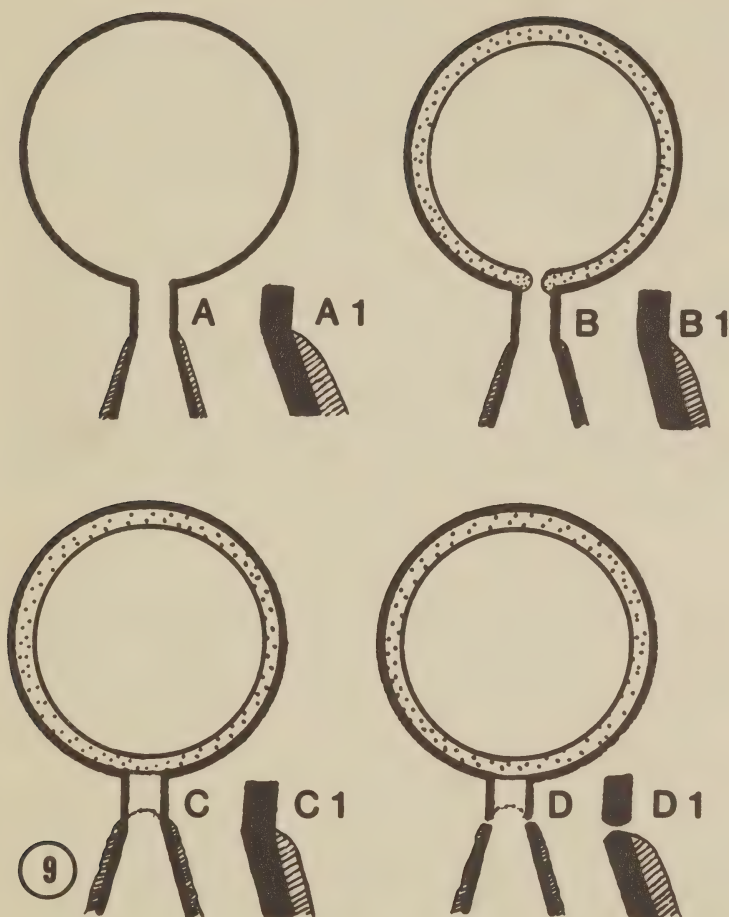


Fig. 9A-D. Diagram of sporangiolium formation in Mycotypha microspora (Based on Khan and Talbot, 1975; Brain and Young, 1979; Higham, 1980). A. Inner wall of denticle is continuous with sporangiolium wall. B. Sporangiospore wall formation. C. Mature sporangiolium. D. Sporangiolium and denticle after dehiscence. A1, B1, C1, D1. Enlarged view of the wall on the lower portion of the pedicel and the upper portion of the denticle in Figs. A, B, C, D, respectively. Legend: Cross-hatched layer=outer wall of denticle; stippled layer=sporangiospore wall; solid line=inner wall of denticle and sporangiolium wall.

yeast-like budding phase in liquid culture but it has been demonstrated here that hyphal dimorphism also occurs on the surface of agar media relatively rich in sugars. Hyphal dimorphism can be readily induced by seeding the surface of an appropriate agar medium with mature sporangiola. The germinating sporangiospores immediately produce yeast-like budding cells that usually do not form the intermediate or mycelial phase until later in the growth cycle (Evans et al., 1978).

Other members of the Mucorales, including Amylomyces rouxii Calmette (Bartnicki-Garcia, 1978) and Cokeromyces recurvatus Poitras (Jeffries and Kirk, 1976; Jeffries and Young, 1983a) also form a yeast-like budding phase in liquid culture, probably induced by reduced oxygen and/or increased carbon dioxide levels. However, species of Benjaminiella and Mycotypha produce yeast-like cells on the surface of solid, nutrient rich, culture media (Benny and Benjamin, 1976). This appears to indicate that slightly anaerobic conditions are not required to induce the production of the yeast-like phase in these taxa.

Species of Benjaminiella, especially B. multispora, resemble Cokeromyces recurvatus in general morphology. Because of this similarity, B. poitrasii was originally described as a species of Cokeromyces (Benjamin, 1960). Benny and Benjamin (1976), however, thought that this resemblance was only superficial, an interpretation which is adopted here. In species of Benjaminiella a circumscissile zone of weakness in the base of the sporangiolum pedicel leaves a denticle on the fertile vesicle after secession, a phenomenon which has never been observed in C. recurvatus (Cole and Samson, 1979). A pigmented deposit with a reticulate appearance, readily visible with the light microscope (Shanor et al., 1950; Benny and Benjamin, 1976) and the transmission electron microscope (Jeffries and Young, 1983b), is produced on the inner surface of the sporangiolum wall in C. recurvatus. Such a deposit is apparently absent from the sporangiola of the superficially similar B. multispora.

The presently monotypic Cokeromyces is excluded from the Mycotyphaceae primarily because of its different sporangiolum sucession mechanism and, to a lesser extent, the unique nature of the morphology of the sporangiolum wall.

Benjaminiella and Mycotypha spp. are reported to have a columella at the base of each sporangium. This has been observed in M. africana (Brain and Young, 1979; Higham, 1980), M. microspora (Khan and Talbot, 1975; present but not noted by Cole and Samson, 1979), and B. poitrasii (Brain and Young, 1979). A columella in Benjaminiella multispora has been observed with the light microscope (Fig. 3c) but its presence in Mycotypha indica must be confirmed by observing ultrathin sections of the fungus with the transmission electron microscope.

Zygospores in species of Benjaminiella, and Mycotypha are all of the Mucor-type (zygosporangium ornamented and pigmented; suspensors opposed), and ornamentation of the zygosporangial wall places these fungi in the following groups (Schipper et al., 1975): A1 (Benjaminella poitrasii); A2 (Benjaminiella multispora, Mycotypha africana, M. indica).

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ADDITIONS TO THE LICHEN FLORA OF THE FAROES

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SUMMARY

Fourteen species of lichens are reported as additions to the known lichen flora of the Faroes, viz. *Acarospora fuscata* (Nyl.) Arn., *Arthrorhaphis citrinella* (Ach.) Poelt, *Aspicilia caesiocinerea* (Nyl. ex Malbr.) Arn., *Caloplaca nivalis* (Körb.) Th.Fr., *Cladonia luteoalba* Wils. & Wheld., *C. merochlorophaea* Asah., *C. cf. subulata* (L.) Wigg., *Huilia flavocaerulescens* (Hornem.) Hert., *Lecanora dispersa* (Pers.) Sommerf., *Lecidella scabra* (Tayl.) Hert. & Leuck., *Massalongia carnosa* (Dicks.) Körb., *Pertusaria corallina* (L.) Arn., *Rhizocarpon lavatum* (Fr.) Hazsl. and *Staurothele fissa* (Tayl.) Zw. Taxonomic notes and notes on fertility and ecology of the species are given.

INTRODUCTION

Owing to their isolated situation in the middle of the North Atlantic, their homogenous geological composition and their modest size, the Faroe Islands are comparatively poor in lichens. About 250 species have previously been reported from the Faroes. Most of them (c. 150 species) are micro-

lichens (K. Hansen & Johansen 1982).

The present authors are of the opinion that the lichen flora of the Faroes is somewhat richer than indicated by the above figures. Recent lichenological papers, e.g., Degelius 1966 and K. Hansen 1968, focus the attention on the more conspicuous macrolichens, and the former of these authors also on some characteristic crustaceous lichens.

The papers dealing more thoroughly with the very intriguing group of Faroese microlichens are relatively old, and the nomenclature used is out of date (Rostrup 1870; Branth 1901). Nevertheless these papers are still of great value, as they are rich in information on localities and habitats for the lichens. A number of lichen communities, e.g., those occurring on the very steep nesting cliffs along the coast, have, however, been neglected previously, mostly because of their inaccessibility.

The Faroe Islands are part of the North Atlantic basalt area and thus are geologically comparable to N.E. Ireland, W. Scotland, N.W. and S.E. Iceland, Jan Mayen, C.E. and C.W. Greenland and Baffin Island. The Faroese plateau-basalt consists of three series of basalt with alternating layers of tuft-agglomerate, coal and clay and intrusive formations.

In 1983 one of us (E.S.H.) received a grant from the Danish Natural Science Research Council for carrying out a quantitative investigation of epilithic lichen communities on the Faroes. During this work, which took place in the summer of 1983, he was assisted by Anna Maria Fosaa. About 400 specimens of lichens were collected. These are now deposited at the Botanical Museum of Copenhagen (C). The present paper is restricted to the lichens that appear to be additions to the known lichen flora of the Faroes.

LIST OF LOCALITIES AND SPECIES

The situation of the eight collecting sites in the Faroe Islands shown on the map (Fig. 1).

- Locality 1. Villingadalsfjall (Vidoy). 62°23'N 6°31'W.
- Locality 2. Eidsvík (Vidoy). 62°22'N 6°31'W.
- Locality 3. Dalá (Vidoy). 62°20'N 6°30'W.
- Locality 4. Mýrnafjall (Vidoy). 62°19'N 6°29'W.
- Locality 5. Kollur (Eysturoy). 62°19'N 7°07'W.
- Locality 6. Eidi (Eysturoy). 62°18'N 7°06'W.
- Locality 7. Sydrugöta (Eysturoy). 62°11'N 6°46'W.
- Locality 8. Tjórndalsá (Vágar). 62°05'N 7°15'W.

The following 14 species are new to the Faroes:

ACAROSPORA FUSCATA (Nyl.) Arn.-Eysturoy: Sydrugöta, on the top surface of basaltic boulder manured by birds, together

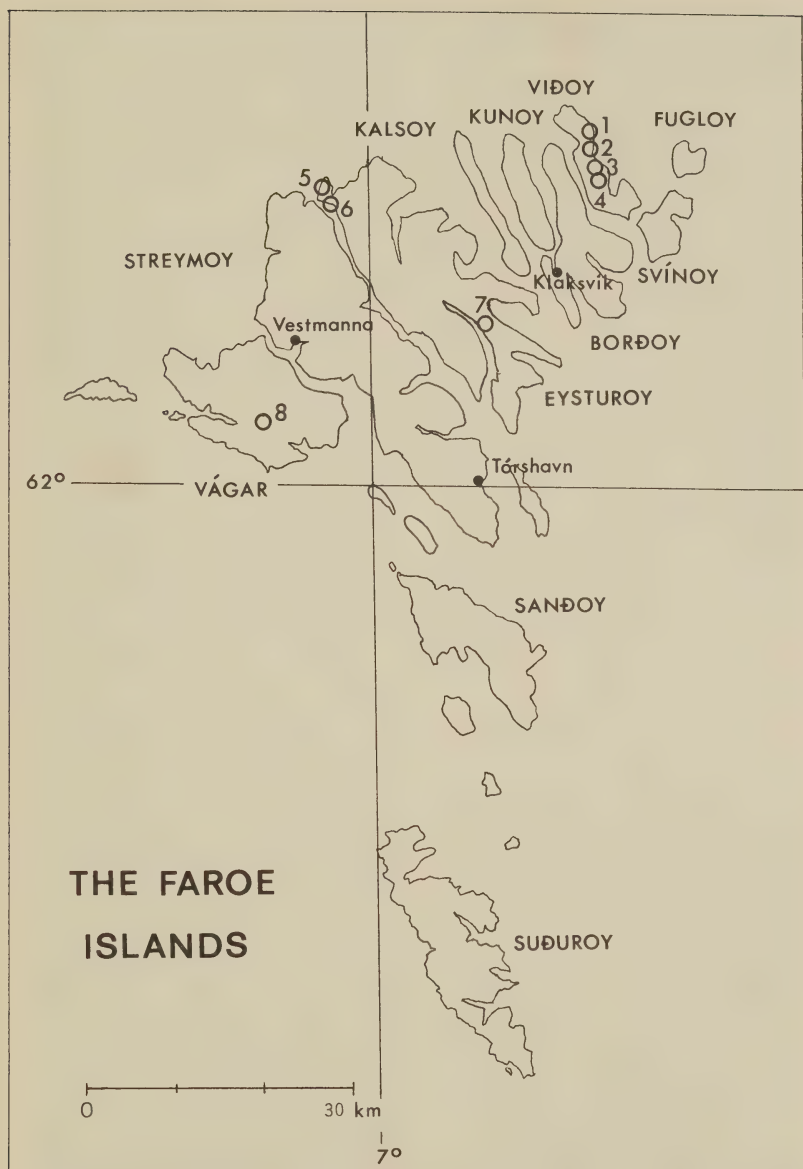


Fig. 1. Location of the eight collecting sites in the Faroe Islands.

with Lecanora intricata (Ach.) Ach. C. ap. The species was determined by J. Poelt.

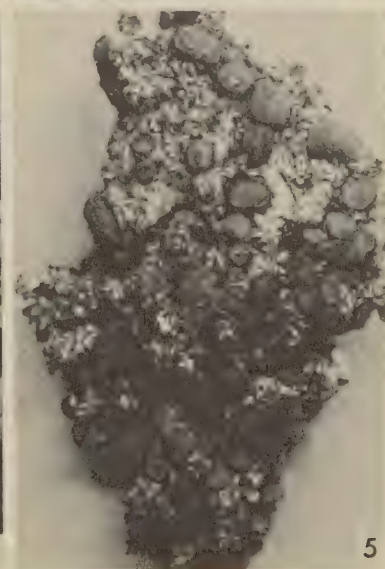
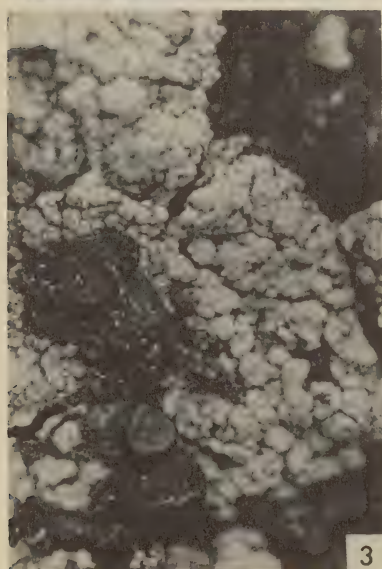
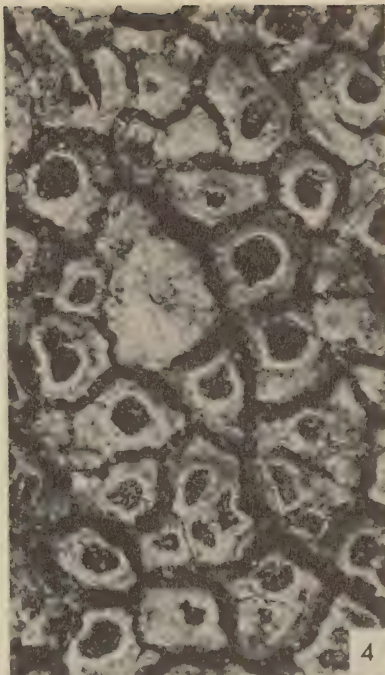
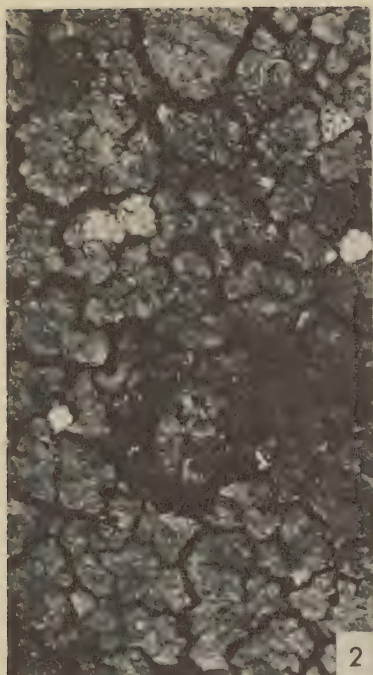
ARTHRORHAPHIS CITRINELLA (Ach.) Poelt (Syn. Bacidia flavovirescens (Dicks.) Anzi). Vidoy: Eidsvík, in Calluna-Nardus heath; Dalá, in openings of Calluna heath; Eysturoy: Kollur, in open Vaccinium heath. C. ap. or ster. - All specimens can be referred to var. citrinella, as the areoles break up into soredia, and as the spores in fertile specimens are 7-11-septate and $> 60 \mu\text{m}$ (Poelt & Vězda 1977). The specimen from Suduroy called Bacidia vacillans (= Arthrorhaphis vacillans Th.Fr.) by Rostrup (1870) and Branth (1901) presumably belongs to the present taxon, which in the Faroes usually is closely associated with Baeomyces placophyllus Ach. or B. rufus (Huds.) Rebent. On Kollur Baeomyces was found to be infested both with Arthrorhaphis citrinella and Epilichen scabrosus (Ach.) Clem. ex Haf.

ASPICILIA CAESIOCINEREA (Nyl. ex Malbr.) Arn. (Syn. Lecanora caesiocinerea Nyl. ex Malbr.).-Vidoy: Eidsvík, on basaltic rock manured by birds, growing together with Lecanora badia (Pers.) Ach.; Dalá, on manured, SW.-exposed face (inclination 55°) of basaltic boulder in Calluna heath, in association with Parmelia saxatilis (L.) Ach. and Candelariella vitellina (Hoffm.) Müll. Arg. C.ap.

CALOPLACA NIVALIS (Körb.) Th.Fr. (Syn. Candelariella nivalis (Körb.) Lett.). - Vidoy: Eidsvík, on mosses on basaltic rock. C. ap. The species was determined by J. Poelt.

CLADONIA LUTEOALBA Wils. & Wheld. - Vágar: Tjørndalsá, in opening of Calluna heath together with, e.g., Baeomyces placophyllus Ach., Cladonia floerkeana (Fr.) Flörke and Botrydina sp. C. luteoalba has been found to contain three different chemical strains (Østhaugen 1972; Krog, Østhaugen & Tønsberg 1980). The present first specimen from the Faroes contains usnic acid and zeorin (TLC by T. Tønsberg) and accordingly belongs to the zeorin strain, which is previously known from Great Britain, Western Norway and Svalbard (Dahl & Krog 1970; Østhaugen 1972).

Fig. 2: Acarospora fuscata (Nyl.) Arn. Areoles with a few (darker) apothecia occurring on basaltic rock at Sydrugöta. 12.7.83 (x7). 3: Arthrorhaphis citrinella (Ach.) Poelt. Fertile thallus growing on soil rich in humus from a heath at Eidsvík. 9.7.83 (x9). 4: Aspicilia caesiocinerea (Nyl. ex Malbr.) Arn. Central part of thallus with numerous apothecia from a basaltic rock near Dalá. 5.7.83 (x7). 5: Caloplaca nivalis (Körb.) Th.Fr. Fertile thallus growing on Andraea at Eidsvík. 9.7.83 (x10).



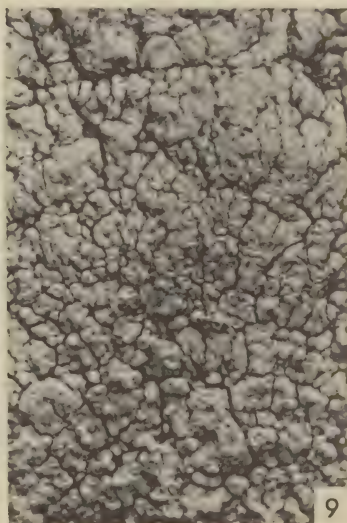
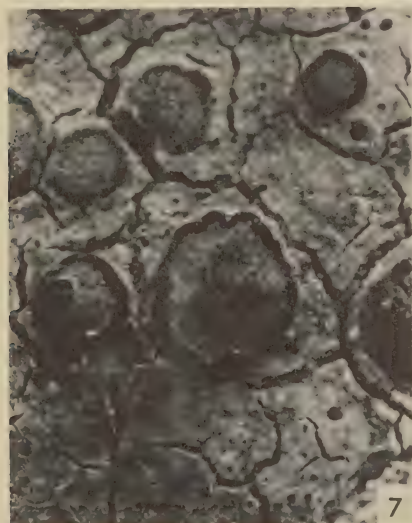
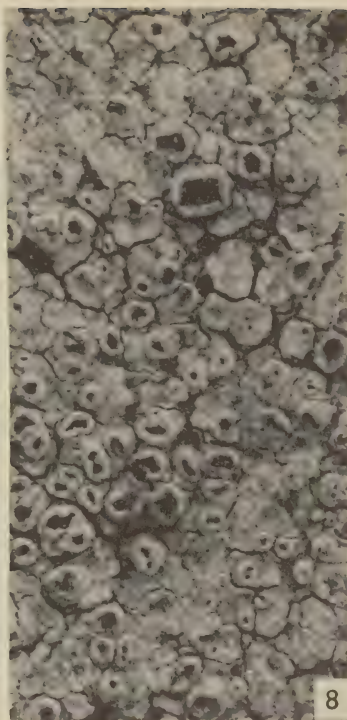
CLADONIA MEROCHLOROPHAEA Asah. - Vidoy: Dalá, in opening of Calluna heath together with Cladonia squamosa (Scop.) Hoffm. Ster. The species was determined by T. Tønsberg, who found the following chemical contents (TLC): merochlorophaeic acid, 4-0-methylcryptochlorophaeic acid, fumarprotocetraric acid and accessories. Novochlorophaeic acid, a more or less common component of *C. merochlorophaea* in some areas, e.g., Greenland (Dahl 1950; Ahti 1966), was not found. *C. merochlorophaea* is considered a well defined species, distinct in chemical as well as morphological characters (Santesson 1984).

CLADONIA cf. SUBULATA (L.) Wigg. (Syn. C. cornutoradiata (Coem.) Vain). - Vidoy: Dalá, in open Calluna heath. Ster. A more definite determination of this single collection with c. ten podetia, 1-2 cm tall, is not possible. T. Tønsberg found (TLC) a content of fumarprotocetraric acid and protocetraric acid.

HUILIA FLAVOCAERULESCENS (Hornem.) Hert. (Syn. Lecidea flavocaerulescens Hornem.). - Vidoy: Dalá, on SW.-exposed, sloping surface of basaltic rock; growing together with Lecidea confluens (Web.) Ach. C. ap. The apothecia are distinctly pruinose contrary to those of Huilia macrocarpa (DC.) Hert., which appears to be more common than *H. flavocaerulescens* in the localities visited in 1983.

LECANORA DISPERSA (Pers.) Sommerf. - Vidoy; Eidsvík, on mortar in small bridge and on basaltic stones (covered with nutritious dust!) in house. - Eysturoy: Eidi, on old bone.-Vágar; Tjørndalsá, on mortar in sheepfold. C. ap. The hymenium does not show any visible colour reaction to HNO_3 , precluding Lecanora albescens (Hoffm.) Flörke in the sense of, e.g., Wirth (1980).

Fig. 6: *Cladonia luteoalba* A. Wils. & Wheld. Primary squamules growing among mosses near Tjørnadalsá. 15.7.83 (x7). 7: *Huilia flavocaerulescens* (Hornem.) Hert. Central part of fertile thallus from a basaltic rock at Dalá. 6.7.83 (x18). 8: *Lecanora dispersa* (Pers.) Sommerf. Fertile thallus growing on a basaltic stone at Eidsvík. 10.7.83 (x18). 9: *Peritussaria corallina* (L.) Arn. Sterile thallus with numerous isidia from Dalá. 7.7.83 (x8).



LECIDELLA SCABRA (Tayl.) Hert. & Leuck. (Syn. Lecidea scabra Tayl.). - Vidoy: Eidsvík, on basaltic stones covered with nutritious dust. - Eysturoy: Eidi, on basaltic rocks influenced by highly nutritious water. Associated lichens: Caloplaca ferruginea (Huds.) Th.Fr. var. festiva (Ach.) Th.Fr.; Catapyrenium lachneum (Ach.) R. Sant. C. ap. The species usually occurs on somewhat weathered, basic to neutral surfaces of siliceous or basaltic rocks, but occasionally grows on wood (Poelt & Vězda 1981; Degelius 1982).

MASSALONGIA CARNOSA (Dicks.) Kőrb. - Vidoy: Villingadalsfjall, 300 m, among mosses on E.-exposed basaltic rock (inclination 30°); Dalá, among mosses on NW.-exposed face (inclination 30°) of basaltic boulder in Calluna heath, in association with Cladonia squamosa (Scop.) Hoffm. and C. subcervicornis (Vain.) Kernst. C. ap. or ster. - Both Henssen (1963) and Thomson (1979) have drawn attention to the fact that Massalongia carnosa is easily confused with Pannaria praetermissa Nyl. (= Parmeliella praetermissa (Nyl.) P. James). In his paper Thomson discusses some important vegetative diagnostic characters that separate these two species. Here the diagnostic spore characters shall be emphasized: M. carnosa has ellipsoid to fusiform, 2-3-celled spores, while those of P. praetermissa are ellipsoid and only 1-celled (see also Jørgensen 1978). - M. carnosa has an arctic-alpine distribution in Europe, North America and Greenland (Poelt 1969; E.S. Hansen 1978; Thomson 1979). In the last-mentioned area (S.W. and C.W. Greenland) it occurs among mosses on moderately sloping to vertical (rarely overhanging) faces of siliceous or basaltic rocks, especially rocks moistened by seeping water.

PERTUSARIA CORALLINA (L.) Arn. - Vidoy: Mýrnaufjall, 400 m, on wind-exposed basaltic rocks together with Lecidea confluens (Web.) Ach., Tremolecia atrata (Ach.) Hert. and Hymenelia lacustris (With.) Poelt & Vězda. Ster. Richly isidiolate.

RHIZOCARPON LAVATUM (Fr.) Hazsl. (Syn. R. obscuratum (Ach.) Mass. f. lavatum (Fr.) Th.Fr.). - Vágar: Tjørndalsá, on mortar in sheepfold, together with, e.g. Xanthoria parietina (L.) Th.Fr. C. ap. The species was determined by J. Poelt. The above-mentioned habitat is not typical, but the present specimen has presumably been dispersed to the sheepfold by wind from the basaltic rocks in the vicinity. The characteristic habitat of R. lavatum has previously been described by, e.g., Poelt & Vězda (1981) and Santesson (1981); the inundation zone of rocks by streams and the shore of lakes.

STAUROTHELE FISSA (Tayl.) Zw. (Syn. S. umbrina (Wahlenb.) Tuck.). - Vidoy: Dalá, on basaltic rock temporarily moistened by seeping water, growing together with Hymenelia lacustris (With.) Poelt & Vězda. C. pe. - The species differs from Staurothele clopima Th.Fr., previously reported from the Faroes by Branth (1901), i.a., by its almost spherical hymenial algae, frequently with 2 cells united, cf. Thomson (1979). The hymenial algae of S. clopima are usually elongate.

ACKNOWLEDGEMENTS

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NEW AND NOTEWORTHY BASIDIOMYCETES (APHYLLOPHORALES) FROM TIERRA DEL FUEGO, ARGENTINE

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SUMMARY

52 species of Aphyllophorales are reported from Tierra del Fuego, Argentine, for the first time. Leptosporomyces luteofibrillosus and Tubulicrinis subfusiformis are described as new. The combination Phellinus andinopatagonicus (Wright & Dechamps) Ryv. is proposed. The phytogeography is discussed and among the polypores there is a strong element of Australian species while northern boreal species dominate among the corticoid species.

The mycoflora of Tierra del Fuego is probably the best known in the whole of South America because of "Flora criptogamica de Tierra del Fuego" of which there has been published 15 volumes. However, the Corticiaceae s. l. has not been treated and one of us (L.R.) was invited to Tierra del Fuego to do the necessary collecting before a flora as such can be undertaken. This paper is the first contribution to the knowledge of the group from the area. However, a second visit will be desirable to do more collecting and thus make the flora more complete, especially because the season during the last collecting was rather dry. The Polyporaceae flora has been written up by Wright and Deschamps (1975). Thus, for this group only hitherto unrecorded species are included in the list. The species are arranged by families and within each family alphabetically according to genus. For each species one or several collection numbers are cited behind the name, and this, taken in connection with the following list of localities, should give the necessary information.

All collections are deposited in the herbarium of Instituto de Botanica "C. Spegazzini" (LPS) with duplicates in the Oslo University Herbarium (O).

List of localities, all in Tierra del Fuego, Argentina, 1982.

Coll. 19091-19210: Estancia Harberton, 18. Feb.

Coll. 19211-19333: Lapataia Nat. Park, W. of Ushuaia, 19.-20. Feb.

Coll. 19334-19389: Lago Escondita, 60 km N. Ushuaia, 21. Feb.

Coll. 19389-19433: Ensanada, W. of Ushuaia, 22. Feb.

Coll. 19434-19502: Monte Olivia, 23. Feb.

All collections were made on Nothofagus sp. unless otherwise stated.

CORTICIACEAE s. lato

Aleurodiscus cerussatus (Bres.) Höhn. & Litsch. 19242.

Asterostroma aff. andinum Pat. 19359, 19390, 19426.

We have not been able to identify with certainty this taxon. According to Parmasto (1970) it seems to be A. andinum s.s.

Athelopsis glaucina (Bourd. & Galz.) Parm. 19337, 19425, 19476. Similar to the species concept but the spores have a slightly navicular appearance, but they are characteristically agglutinated in pairs or 3-4.

A. subinconspicua (Litsch.) Jülich. 19408.

Botryobasidium botryosum (Bres.) John Erikss. 19093.

B. candicans John Erikss. 19462 (anamorph lacking), 19464 (with anamorph).

B. subcoronatum (Höhn. & Litsch.) Donk. 19357, 19456.

Brevicellidium olivascens (Bres.) Larss. & Hjortst. 19221.

Ceraceomyces borealis (Rom.) John Erikss. & Ryv. 19235. Short-spored form, 5-6 μ m long.

Coniophora arida (Fr.) Karst. 19347.

Gloeosoma vitellinum (Lév.) Bres. 19334. This poorly known species needs further study in order to confirm its generic status. Primarily because of its cyphelloid and substipitate fruitbody we prefer to maintain Gloeosoma Bres. instead of Aleurodiscus. See also Lemke (1964).

Hyphoderma argillaceum (Bres.) Donk. 19158

H. praetermissum (Karst.) John Erikss. & Strid. 19366, 19367, 19380, 19485, 19489.

H. puberum (Fr.) Wallr. 19455.

H. roseocremeum (Bres.) Donk. 19305.

H. setigerum (Fr.) Donk. 19433/c.

Hyphodontia alutaria (Burt) John Erikss. 19135, 19441, 19447, 19449, 19468, 19469. The lagenocystidia which occur abundantly are more robust and longer than normal, mostly up to 70 μ m in length. In other characteristics, such as macromorphology and size of the spores, the specimens conform to the species concept.

H. rimosissima (Peck) Gilbn. 19502.

H. sambuci (Pers.) John Erikss. 19092, 19094, 19152, 19243, 19244, 19255, 19256, 19393, 19410, 19420, 19433/b,

19436. No. 19436 is a rather thick form and the spores are close to those of var. angustispora Parm.

H. subalutacea (Karst.) John Erikss. 19225, 19484.

Hypochniciellum cremeoisabellinum (Litsch.) Hjortst. 19123, 19395.

Kavinia albobiridis (Morgan) Gilbn. & Bud. 19109, 19248, 19378, 19463. This well-known species is easily recognized by its greenish aculei and rough (warted) spores. No. 19463 is a young specimen but deviates from the normal circumscription in having echinulate spores which are best observed in cotton-blue.

LEPTOSPOROMYCES LUTEOFIBRILLOSUS Hjortst. & Ryv. spec. nov. Fructificatio resupinata, effusa, laxe adnata, cremeoalbida vel subochracea; rhizomorphae distinctae, luteae; systema hyphale monomiticum, hyphae basales plus minus rectae, hyalinae, in parte lutescentes, 2.5-3.5, raro 4.5-5 μ m latae, fibulatae, hyphae subhymeniales confertae, fibulis indistinctis; basidia subclavata, modice pedunculata, 11-15 x 3.5-4 μ m, 4 sterigmatibus; sporis anguste ovatis, tenuitunicatis, hyalinis, laevibus, generatim 3.5-4 x 2-2.2 μ m, neque amyloidibus, neque dextrinoidibus, neque cyanophilis. Holotypus: Argentina. Tierra del Fuego. Lapataia Nat. Park, 15 km W. of Ushuaia. 19-20.II.1982. L. Ryvarden 19211 (O). Isotypus: (LPS and GB).

Fruitbody resupinate, effuse, loosely adnate, pellicular to slightly membranaceous, pliable, smooth, cream-coloured to light ochraceous, margin indefinite; rhizomorphs yellowish, running below the subiculum; hyphal system monomitic, basal hyphae thin-walled or with slight wall thickening, hyaline or becoming light yellowish next to the substratum, usually 2.5-3.5 μ m broad, rarely up to 5 μ m, with clamps, subhymenial hyphae with cells more or less compressed and irregular, with clamps but rarely observed; basidia subclavate, indistinctly pedunculate, 11-15 x 3.5-4 μ m, with 4 sterigmata and a basal clamp; spores narrowly ellipsoid, thin-walled, hyaline, smooth, generally 3.5-4 x 2-2.2 μ m, non-amyloid, non-dextrinoid, non-cyanophilous.

Remarks. This is a striking species as the yellow rhizomorphs could scarcely be overlooked under a lens.

Further characteristics are the athelioid fruitbody, the narrowly ellipsoid spores and the irregularly and short subhymenial hyphae. Among the athelioid fungi the new species is similar to Confertobasidium olivaceoalbum (Bourd. & Galz.) Jülich and Leptosporomyces roseus Jülich. It is readily separated from the former by lacking brown pigmented hyphae and from the latter by its narrowly ellipsoid spores and smooth hymenium. The blistery hymenial surface of L. roseus is also a striking characteristic. Further, neither C. olivaceoalbum nor L. roseus have yellowish rhizomorphs but rather brownish (in the former) and rosy to light brown (in the latter).

The various segregates from Athelia Pers. have been placed into several genera, e.g. Confertobasidium, Fibulomyces and Leptosporomyces. The delimitation of these genera remains

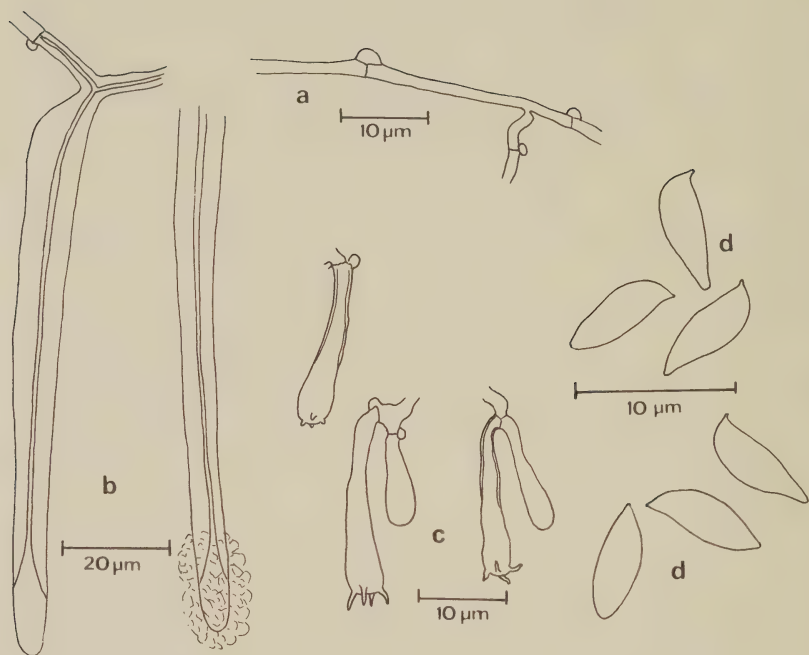


Fig. 1. Leptosporomyces luteofibrillosus, a) hyphae from the rhizomorphs, b) hyphae from the subhymenium, c)-d) basidia, e) spores. From the holotype.

vague. C. olivaceoalbum, L. roseus, and L. luteofibrillosus can scarcely be separated at generic level. The fruit-bodies, occurrence of rhizomorphs, and the appearance of basidia and spores are very similar and in our opinion applicable only on specific delimitation.

Melzericium udicolum (Bourd.) Hauersl. 19251, 19292, 19433/a. Variable, spores often more than 10-12 μ m long. vague (linje 46 her begynner øverste linje fra gamle s. 4)

Peniophora incarnata (Pers.:Fr.) Karst. 19157, 19289, 19409, 19452.

Phanerochaete sordida (Karst.) John Erikss. & Ryv. 19373.

Phlebia rufa (Pers.:Fr.) M.P. Christ. 19160, 19374, 19392.

Ph. subcretacea (Litsch.) M.P. Christ. 19120.

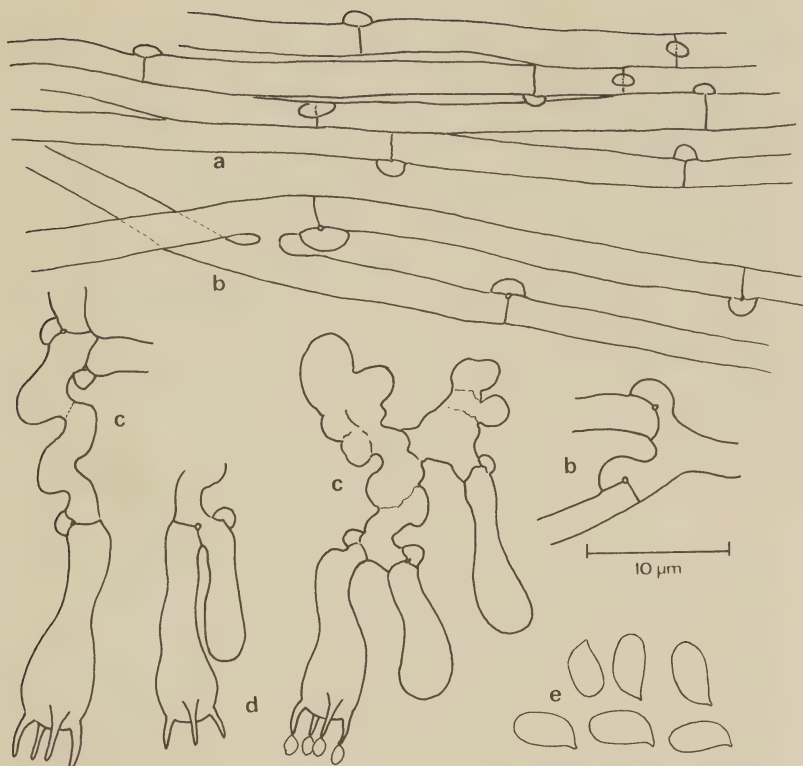


Fig. 2. Tubulicrinis subfusiformis, a) hyphae, b) cystidia, c) basidia, d) spores. From the holotype.

Plicatura nivea (Sommerf.:Fr.) Karst. 19460. The spores are not amyloid and slightly broader than normal, generally 1.5-1.8 μm in diam.. The amyloidity, however, is very little pronounced also in specimens seen from the northern hemisphere and is best studied when the spores are packed together.

Schizopora paradoxa (Schröd.:Fr.) Donk. 19097, 19111, 19147, 19230, 19311, 19344, 19435, 19458.

Scopuloides hydroides (Cooke & Massee) Hjortst. & Ryv. 19368, 19372.

Scytinostroma ochroleucum (Bres. & Torr.) Donk. 19142, 19148. The gloecystidia have a very strong aldehyde reaction.

Serpula himantioides (Fr.:Fr.) Karst. 19180, 19216, 19375, 19473.

Sistotrema brinkmannii (Bres.) John Erikss. 19151, 19346/b, 19369, 19437, 19486. No. 19346/b is not typical and has spores with adaxial side mostly convex or straight. The fruitbody is also more yellow but still with a grandinioid appearance.

Sistotremastrum niveocreum (Höhn. & Litsch.) John Erikss. 19309, 19446, 19457.

Stereum hirsutum (Willd.:Fr.) S.F. Gray. 19107, 19115, 19127.

Subulicystidium longisporum (Pat.) Parm. 19161, 19342, 19343. No. 19342 has very large spores, up to 25 um in length and 1.5-2 um wide.

Tomentella crinalis (Fr.) M.J. Larsen. 19095.

Trechispora farinacea (Pers.:Fr.) Libert. 19099, 19400.

T. aff. vaga (Fr.) Libert. 19101, 19143, 19214, 19348, 19379, 19472. All these specimens are readily recognized to the section Ramariella Parm. and appear related to T. christiansenii and T. vaga.

Tubulicrinis hamatus (Jacks.) Donk. 19104.

T. glebulosus (Bres.) Donk. 19096, 19318, 19443. The species is here determined in a broad sense with spores and cystidia somewhat different. See also following species.

TUBULICRINIS SUBFUSIFORMIS Hjortst. & Ryv. spec. nov.

Species Tubulicrini glebuloso et angusto affinis sed sporis subfusiformibus (6-)6.5-7 x (2.2-)2.5 um lycystidiis cylindricis, circiter 90-100 um longis, versus apicem acuminatis, 3.5-5 um latis, neque amyloidibus.

Holotypus: Argentina. Tierra del Fuego. Ensenada, 15 km W. of Ushuaia. 22.II.1982. L. Ryvarden 19422 (O). Isotype: LPS. Paratypus: 19113 (O, LPS, GB).

Fruitbody resupinate, effuse, closely adnate, thin or with age thickening, whitish to ochraceous, pilose owing to protruding cystidia; hyphal system monomitic, basal hyphae thin-walled, straight, (1.8-)2-2.5 um wide, subhymenial hyphae short-celled, up to 2.5-3 um wide, all hyphae with clamps; lycystidia more or less cylindrical, 90-100 um long and 9-10 um wide near the base, narrowing towards the obtuse apex, and 3.5-4.5 um wide, non-amyloid or with slightly greyish reaction in Melzer; basidia subclavate, 12-20 x 3.5-4(-4.5) um, towards the base with slight wall thickening, 4 sterigmata and a basal clamp; spores subfusiform (6.)6.5-7.5 x (2.2-)2.5 um, thin-walled, hyaline, smooth, non-amyloid, non-dextrinoid, non-cyanophilous.

Remarks. The distinctive features of this new species are the subfusiform to navicular spores and cylindrical, non-amyloid cystidia with the capillary lumen ending gradually towards the obtuse apex. This species must be regarded as closely related to T. glebulosus (Bres.) Donk and T. angustus (Jacks. & Weres.) Donk which have similar cystidia but both differ from T. subfusiformis by their cylindrical to slightly curved spores.

Xenasmatella tulasnelloidea (Höhn. & Litsch.) Oberw. ex Jülich. 19141, 19149, 19166.

HYMENOGASTRACEAE

Phellinus andinopatagonicus (Wright & Deschamps) Ryv. comb. nov. Basionym: Pyrroderma andinopatagonicus Wright & Deschamps. Rev. Invest. Agrop. INTA, ser. 5. Pat. Vegetale 9(3):154, 1972. 19175, 19384.

This is a common species in the area. As we prefer to keep Phellinus in a rather wide sense, it is transferred to this genus. The presence of a crust on the pileus alone is hardly a generically significant character.

POLYPORACEAE

Antrodia gossypina (Speg.) Ryv. 19114, 19461. The species was originally described from La Plata close to Buenos Aires, and the type was the only collection known from the country until it was found in Tierra del Fuego. Rajchenberg (1982) cites also one collection from southern Chile. The species causes a strong degrading brown rot in the attacked wood.

Ceriporia reticulata (Fr.) Dom. 19376. According to Rajchenberg (1982:49) the species has not previously been found in Argentina. It has a World-wide distribution.

Macrohyporia dictyopora (Cooke) Joh. & Ryv. 19434. Previously not known from South America but recorded from Australia and Malawi (Johansen & Ryvarden 1980:422).

Polyporus melanopus Fr. 19228. It may be that this is the same fungus as Wright & Deschamps (1975) recorded as Poly-porus dictyopus Mont. Coll. 19228 had the typical warm brown colour of P. melanopus as it is seen in Northern Europe from where it was described. P. dictyopus Mont. was described from Juan Fernandez and according to our concept it is a widespread taxon with a predominantly tropical distribution.

Trametes pubescens (Fr.) Pil. 19236. The species is related to T. versicolor (Fr.) Pil. which is very common in Tierra del Fuego, but easily separated by its thicker fruitbodies which dry distinctly pale straw-coloured.

Rigidoporus undatus (Fr.) Donk. 19363. According to Rachjenberg (1982) not previously known from Argentina.

Tyromyces campylus (Berk.) Ryv. 19427. An Australian species restricted to Nothofagus and previously not known from South America.

T. dissectus (Lév.) Ryv. 19351, 19397, 19492. Originally described from Southern Chile, but previously not reported from Argentina. It is very similar to T. exiguus (Col.) Cunningh., from Australia, and ultimately the two names may prove to be synonymous. Furthermore, T. floriformis (Quel.) Donk from the Northern hemisphere and mostly found on conifers, is also related, but normally it remains white with age and on drying. T. dissectus darkens with brown colours with age and on drying.

T. pelliculosus (Berk.) Cunningh. 19110, 19385, 19475. Syn.: Spongipellis chubutensis Wright & Deschamps. After having examined specimens collected in Australia with those from Tierra del Fuego, we concluded the two species were synonymous.

SEPTOBASIDIALES

Septobasidium spp. 19416, on living Nothofagus. It is rather surprising to find a Septobasidium in Tierra del Fuego with its harsh and cold climate, the genus is in general confined to tropical or warm temperate zones because of the host insects. In Couch (1938:54-55) we have been unable to find any species reported from Nothofagus, and probably the specimen represents a new species.

However, as we have only a single sterile specimen (only a few allantoid spores, $20 \times 5 \mu\text{m}$, were observed) we refrain from making a formal description until more and fertile material is available.

Discussion

Nothofagus has a fascinating distribution with its occurrence in southern part of South America and then Australia, New Zealand and Papua, New Guinea. It is now known that these areas were formerly connected but then drifted thousands of kilometres apart. Not only Nothofagus became disjunct with this development, but also many species of fungi connected with the genus. A prominent example is the ascomycete genus Cyttaria known only from Nothofagus and following the host almost everywhere. Among the species reported here and in the paper of Wright Deschamps (1975) the following species comes also into this category: Macrohyporia dictyopora, Piptoporus portentosis, Tyromyces cam-pylus, T. pelliculosus and T. dissectus (assumed synonymous with the Australian species T. exiguus). In the same group, but not connected with Nothofagus is Phaeotrametes decipiens which in South America is known north of the Nothofagus area. In addition to the few endemic species, the Polyporaceae include widespread boreal-temperate species like Trametes versicolor, T. pubescens, Pol. melanopus, Rigidoporus undatus and Ceriporia reticulata. It is interesting to note that the two disjunct areas have no species in common from the Hymenochaetaceae but rather have endemic species on Nothofagus in both areas, such as Phellinus andinopatoganicus and Inonotus crustosus in Argentine, and Phellinus nothofagi, Phellinus kamahi and Ph. tawhai in Australia-New Zealand. It could be an indication that Hymenochaetaceae evolved rather late so there was no common species from the family when the Nothofagus area was coherent. Later immigration to the two independent areas then led to different species formation in this family. Apart from the endemic species and a few American ones, almost all recorded species in the Corticiaceae are also known from Scandinavia and has a wide distribution in the northern hemisphere. They must either have migrated along the Andes mountain chain or have been part of a common flora which later was split into two grossly disjunct areas. The Corticiaceae of Australia is in spite of Cunningham's monograph (1963) rather poorly known as collecting in Australia has been rather scarce. Thus a comparison between the two groups remain difficult.

Acknowledgements

Financial support from the Norwegian Research Council and Flora Criptogamica de Tierra del Fuego Project is deeply acknowledged. My sincere thanks goes to Professor Dr. I.J. Gamundi de Amos who made my stay in Tierra del Fuego a very pleasant and profitable one. Dr. D. Pegler, Kew, has

suggested linguistic improvements for which we are grateful.

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MYCOTAXON

Vol. XXII, p. 168

January-March 1985

N O T I C E

NORTHEAST MYCOLOGY CONFERENCE

The 8th annual Northeast Mycology Conference (formerly New England Mycology Conference) will be held at the New York State Museum in Albany, New York on Saturday, April 20th, 1985. It will feature a symposium on the history of mycology in the northeastern U. S.

Registration forms, directions, and information on accommodations will be mailed by the end of February. The nominal registration fee is planned to include a published copy of the symposium proceedings.

Because of the symposium, there will be no time for contributed papers this year, but a limited number of poster session spaces are available. Historical topics are particularly encouraged but all topics are welcome. If you wish to submit a poster, there will be a form in the February mailing.

For further information contact either:

J. H. Haines
New York State Museum
Room 3132 CEC
Albany, NY 12230
(518) 474-5809

I. F. Salkin
Wadsworth Center for
Labs. & Res.
N.Y. State Dept. of Health
Albany, NY 12201
(518) 474-2171

MYCOTAXON

Vol. XXII, pp. 169-195

January-March 1985

NEW OR INTERESTING MEMBERS OF THE LICHINACEAE FROM SOUTHERN AFRICA

I. SPECIES FROM NORTHERN AND EASTERN TRANSVAAL

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SUMMARY

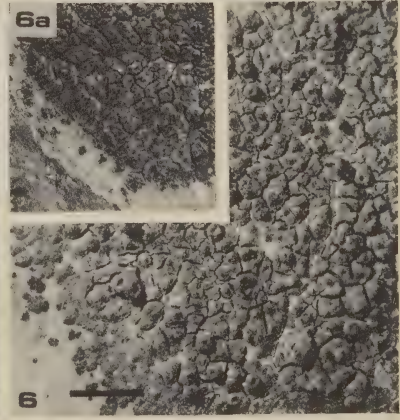
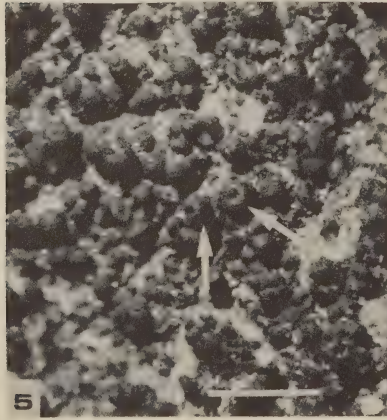
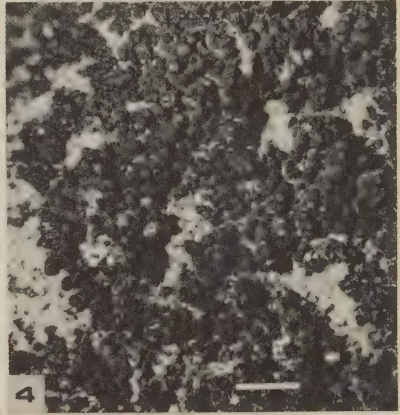
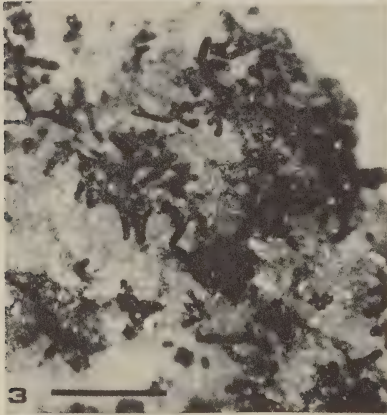
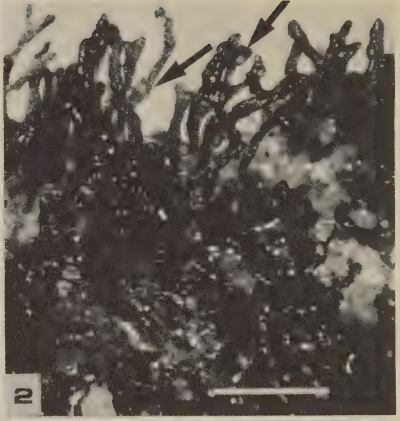
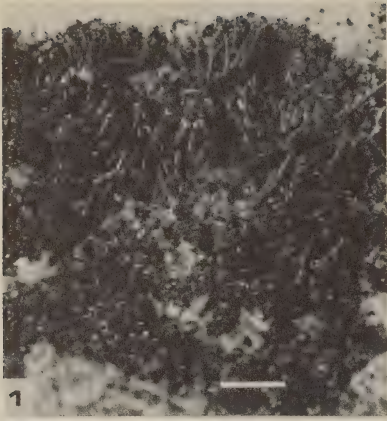
The new species Lichina macrospora, Pterygiopsis convexa, P. melanophthalma, P. submersa, and Thyrea rotundata are described from the northern and eastern Transvaal. A second, newly found locality of Porocyphus effiguratus is reported from the northern parts of Transvaal.

INTRODUCTION

This paper represents the first in a series which will deal with members of the Lichinaceae collected on seepage rocks along the escarpment of the northern and eastern Transvaal. Five new species of the genera Lichina, Pterygiopsis and Thyrea are described, and a new locality of Porocyphus effiguratus Henssen is reported. This lichen was previously only known to occur in Zimbabwe (Rhodesia).

MATERIAL AND METHODS

MATERIAL. Porocyphus effiguratus Henssen (Henssen 1974). Zimbabwe, Inyanga, Erin, on partly submerged rocks of a waterfall at 2000 m (isotype: MB). Pterygiopsis atra Vain., isotype (TUR, herb. Vain. 12479). Thyrea polyglossa (Nyl.) Zahlbr., lectotype (H, herb. Nylander 42671).



METHODS. The internal morphology of the thallus and fruiting structures were studied by means of freezing microtome sections embedded in lactophenol cotton-blue (LPCB). For the determination of the iodine reaction, a solution of J-KJ was added to sections or squash preparations without pre-treatment. The given measurements either refer to sections and squash preparations in LPCB, or to air dry material.

TAXONOMIC PART

1. A new non-marine species of Lichina

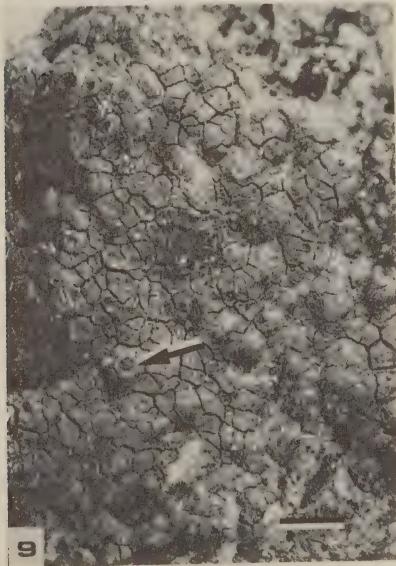
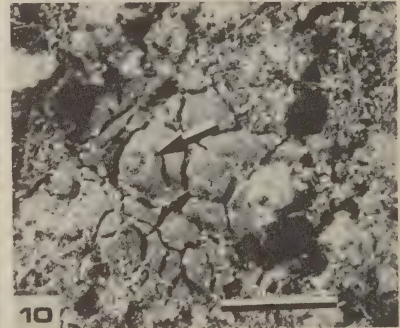
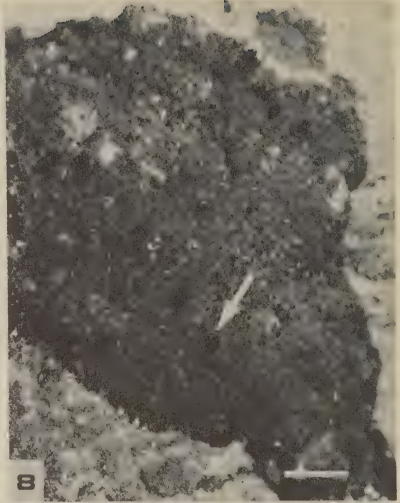
The new species Lichina macrospora represents an additional species of the non-marine members of the genus. It is very closely related to L. willeyi (Tuck.) Henssen and L. tasmanica Henssen. The three species might be included in the Lichina willeyi-group which is separated from the other non-marine species of the genus by the presence of terminal ascocarps, as well as the protrusion of algal filaments from the thalli under certain environmental conditions.

Lichina macrospora Henssen, Büdel et Wessels sp. nov.

Figs. 1-3, 16-22.

DIAGNOSIS. Thallus minutus, fruticulosus, nigricans, substrato affixus disco basali. Lobi erecti teretes, simplices vel sparsim ramosi, 0.6-1.6 mm longi et 0.05-0.15 mm lati. Hyphae velut scaturi-

Figs. 1-3. Lichina macrospora (parts of holotype). 1. Slender lobes, in part overgrowing a species of Pterygiopsis. 2. Slender, wettened lobes with intercalar or subterminal pycnoascocarps. 3. Development of vertical lobes from horizontal initial stages. Figs. 4-5. Pterygiopsis convexa (holotype). 4. Thalli composed of densely aggregated, in part effigurate lobes. 5. Lobes and apothecia (arrows) at a higher magnification. Fig. 6. Pterygiopsis submersa (holotype). 6. Zonated, young thallus. 6a. Juvenile thallus surrounded by a distinct prothallus. Scale = 1 mm.

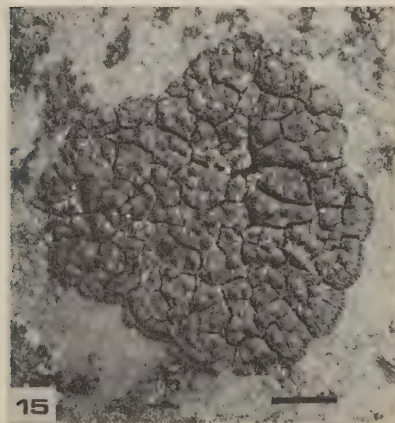
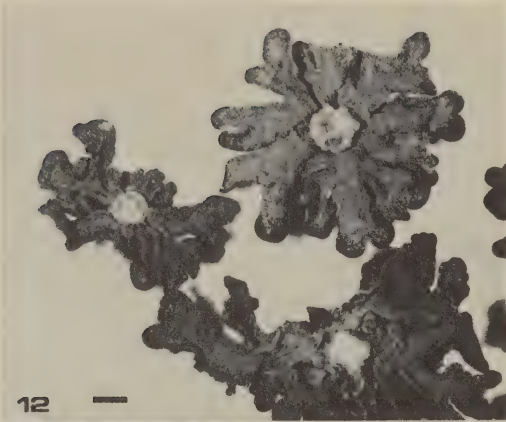


go, cellulae cylindraceae vel angulares, 6-7(-12) μm longae. Apothecia typo pycno-ascocarpo, terminalia, usque 0.3 mm lata; Hymenium amyloideum, (150-)190-265 μm altum, superne fuscum; paraphyses c. 1 μm crassae, deinde apicem versus moniliformes et 4 μm latae. Asci cylindracei (vel obclavati), (60-)105-140 x (9-)12-14(-21) μm , octospori. Sporae eseptatae, incolores, ellipsoideae vel plus minusve angulatae (in asco), 14-18 x 8-12 μm . Conidia bacilliformia, 3.5-4.5 x 1-1.5 μm . Alga ad familiam Rivulariacearum pertinens.

Holotype: Republic of South Africa, Eastern Transvaal, Graskop 2430DD, Panorama Falls, Look-out Point, on sandstone plates along the edges of rivulets and streams, c. 1400 m, 1982, Henssen & Wessels 28405a (MB); (isotype: PRE); additional collection from the same site Henssen no. 28392b.

Thallus minute, blackish, composed of scattered or aggregated decumbent or erect, terete lobes. Lobes simple or sparsely branched, 0.6-1.6 mm long and 0.05-0.15 mm wide. Thallus in sections 100-220 μm thick. Hyphae in the characteristic fountain-like arrangement, the lateral parts gradually arcuate to the thallus edge. Hyphal cells mostly angular and 6-7 x 3-5 μm , infrequently cylindrical and up to 12 μm long, cells inconspicuously elongated in the central part of the lobes. Phycobiont probably a species of Dichothrix. Filaments confined to the outer parts of the thallus, the tapering tips protruding or not; if protruding then surrounded by a gelatinous sheath c. 7 μm thick; filaments 95-130 μm long, 6-7 μm broad at the base, tapering to 1.5-2 μm at the tip, basal heterocyst 6-7 x 6-7 μm .

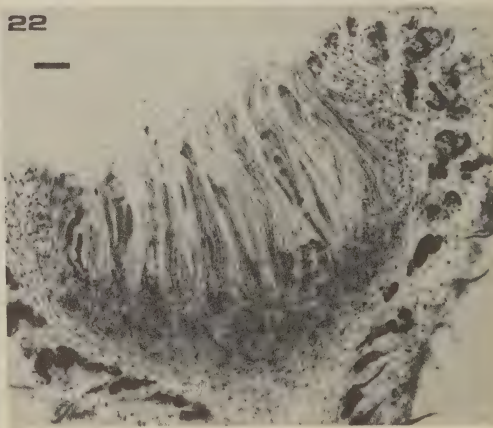
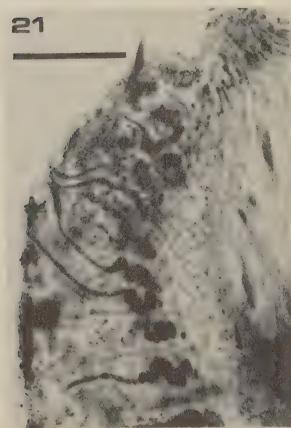
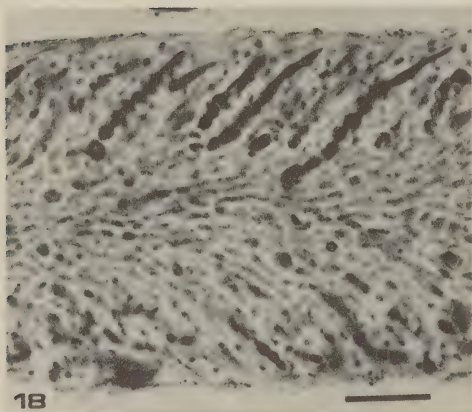
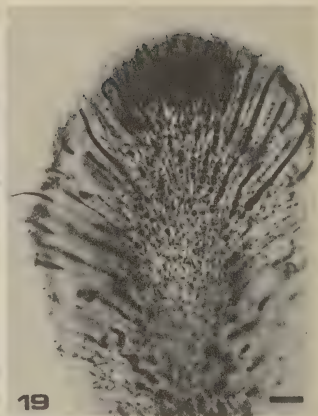
Fig. 7. Pterygiopsis submersa (holotype). Part of thallus with large apothecia, majority without hymenium. Figs. 8-10. Pterygiopsis melanophthalma (8-9, holotype; 10, Henssen 28392a). 8. Black apothecial discs within moist thallus. 9. Dry thallus, apothecium indicated by an arrow. 10. Small thallus bearing large protruding apothecium (arrow). Fig. 11. Thyrea rotundata (holotype). Thallus, upper surface view. Scale = 1 mm.



Apothecia pycnoascocarps, with a thalline margin, terminal or superimposed, up to 0.3 mm broad, disc punctiform and brownish. Primary paraphyses (= elongated conidiophores) gelatinizing, secondary paraphyses sparsely branched and anastomosing, the tips enlarged to 4 μm and moniliform. Hymenium (150-)190-265 μm high, subhymenium 120-150 μm , staining intensely in LPCB, hymenium gelatine staining blue in iodine. Excipulum (the former pycnidial envelope) restricted to the marginal part, 15-30 μm broad, composed of loosely interwoven hyphae, thalline margin 50-60 μm broad. Asci cylindrical with spores uniseriate 105-140 x (9-)12-14 μm , or obclavate with spores partly biseriate 60 x 21 μm ; ascus wall evanescent. Conidia rod-shaped, 3.5 x 1-1.5 μm .

Ecology and distribution. Lichina macrospora was found on the banks of a rivulet, in the proximity of where it flows down the edge of the escarpment from the so-called Panorama falls. The lichen was growing on hard sandstone plates of the western facing (gentle) slope which is dissected by slow running seepage streams with a permanent water supply. Only during prolonged drought do the seepage streams dry out. The area has a predominantly summer rainfall with an average of more than 1700 mm yr^{-1} (Middleton et al. 1981). Fog and dew frequently occurs during the year. Lichina macrospora is only known from the type locality.

Figs. 12-13. Thyrea rotundata (holotype). 12. thalli seen from below with distinct umbilicus and furrowed lobes. 13. Upper surface view of lobe tip, apothecia indicated by arrows. Figs. 14-15. Porocyphus effiguratus (Büdel 14036c). 14. Part of large thallus with effigurate margin, apothecia indicated by arrows. 15. Young, compact thallus. Fig. 16. Lichina macrospora (holotype). Thallus overgrowing a species of Pterygiopsis, lobes stout with terminal or superimposed pycnoascocarpia (arrows). Scale = 1 mm.



Remarks. The thalli were either growing on stone at the water level of seepage streams with only their basal parts frequently inundated, or they were overgrowing the new species Pterygiopsis melanophthalma and other crustose lichens. The latter sites were sometimes temporarily flooded by the seepage streams. The lobes of thalli from the former sites were relatively long and slender (Figs. 1, 2), and the algal filaments did not protrude (Figs. 17, 18). Thalli collected from the temporarily flooded sites had stout lobes with protruding algal filaments and were covered by a thick layer consisting of a variety of blue-green algal species (Figs. 16, 19-22). A discussion of the lichen association found on these rocks is given under Pterygiopsis melanophthalma.

The vertical part of a mature thallus develops from a horizontal initial stage (Fig. 3). Fully developed thalli are composed of either scattered or densely aggregated lobes which can be erect or decumbent.

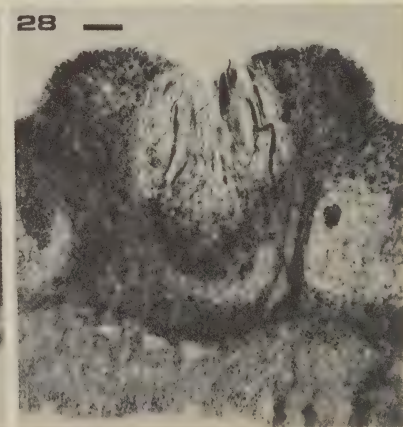
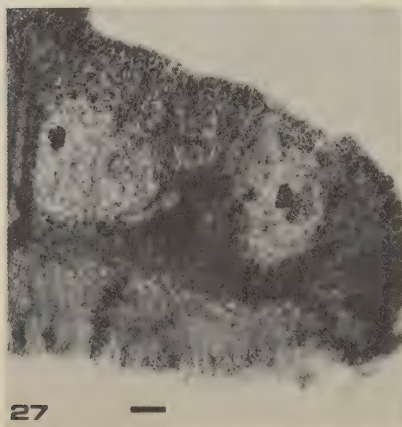
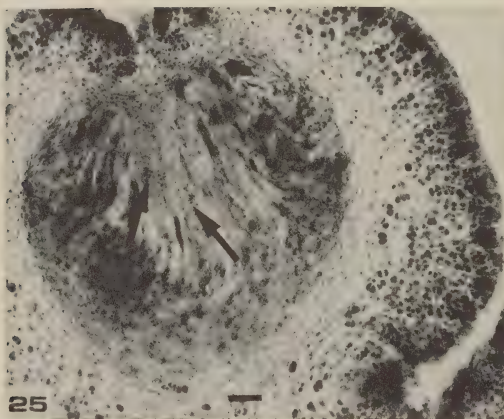
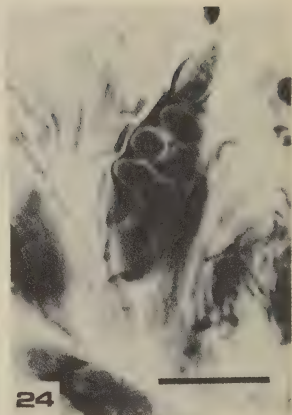
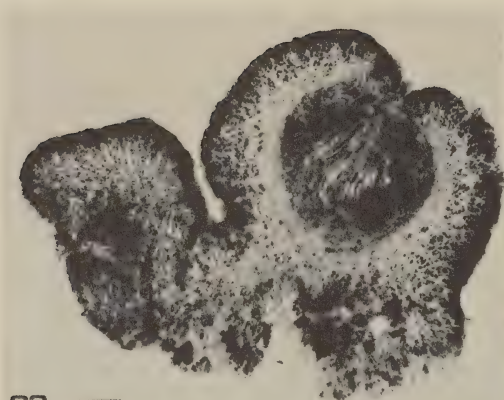
Tab. 1

Differentiating characteristics of the Lichina willeyi-group

	<u>L.macrospora</u>	<u>L.tasmanica</u>	<u>L.willeyi</u>
size of ascocarps	0.3 mm	0.6 mm	0.4 mm
size of spores (µm)	14-18 x 8-12	13-16 x 7-12	11-14 x 8-12
length of lobes	0.6 - 1.6 mm	7 - 10 mm	1 - 3 mm
width of lobes	0.05 - 0.15 mm	0.2 - 0.5 mm	0.1 0.15 mm

Lichina macrospora is characterized by the presence of relatively small lobes in combination with large spores. Tabel 1 summarizes the characteristics differentiating the three species be-

Figs. 17-21. Anatomy of Lichina macrospora (holotype). 17-18. L.s. of slender lobes, the algal filaments not protruding. 19-20. Lobe tips with protruding algal filaments. 21-22. Different parts of apothecia. Scale = 20 µm.



longing to the Lichina willeyi-group. In habit L. macrospora closely resembles L. willeyi. In contrast to the other two species, the hyphal cells of the central strand of L. macrospora are inconspicuously elongated (Fig. 18). The apothecia of L. macrospora are pycnoascocarps, as found in all other non-marine species of Lichina (Henssen, 1969; 1973). True (secondarily formed) paraphyses with moniliform tips are distinctly visible in old apothecia (Fig. 21).

2. Three new species of Pterygiopsis

Three species of our lichen collections made in the north-eastern Transvaal turned out to belong to Pterygiopsis, a genus which has not been previously recorded from Africa. Pterygiopsis is characterized by thick-walled asci and a fan-shaped arrangement of hyphae in a placoid thallus (Henssen, 1963). Similar to the type species, P. atra Vain. (Henssen, 1979), the new species have octosporous asci. An initial stage of ascocarp development was observed in Pterygiopsis convexa and P. submersa. In P. submersa the primordium consisted of spirally coiled ascogonia and relatively few hyphae of generative tissue embedded in a gelatinous matrix (Fig. 30). A later stage was observed in P. convexa (Fig. 43). Well developed apothecia were found only in P. melanophthalma. The hymenium in P. melanophthalma and P. submersa is secondarily divided by hyphal strands forming columns which are wider at the top, an excipulum is restricted to the upper margin (Figs. 27, 29,

Figs. 23-28. Anatomy of Pterygiopsis species.

Figs. 23-26. P. convexa (holotype). 23. L.s. of

lobe and apothecium. 24. Ascus and paraphyses.

25. L.s. of apothecium, hymenium containing intruding filaments of associated blue-green alga.

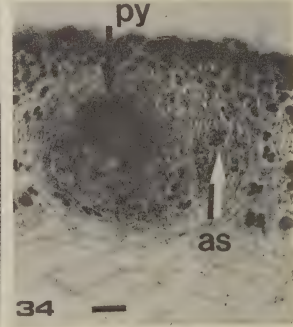
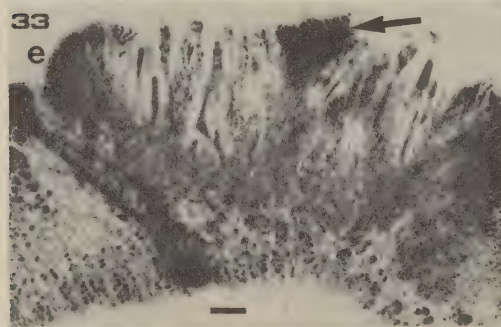
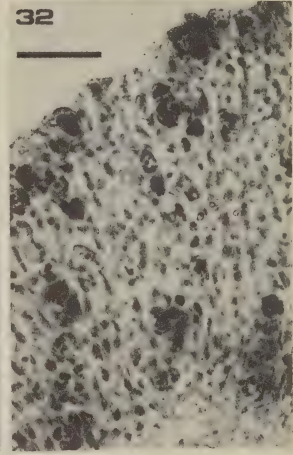
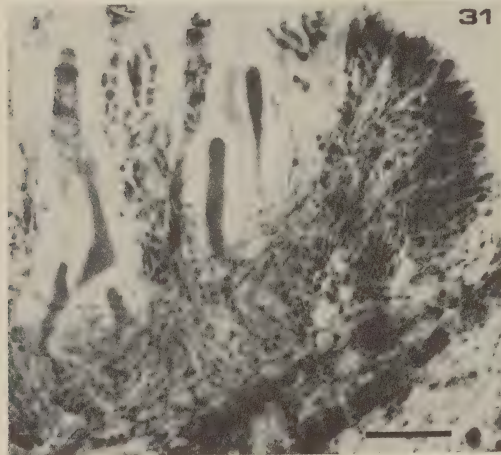
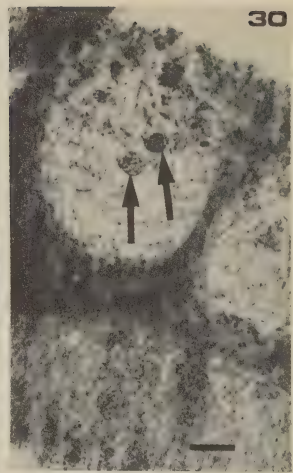
26. L.s. of lobe, cells of phycobiont aggregated at the lower surface (arrow). Figs. 27-28. P. sub-

mersa (holotype). 27. L.s. of lobe with attach-

ment base and two apothecial primordia. 28. L.s.

of apothecium. Scale in 23 = 50 μm , in 24-28 =

20 μm .



33). The upper parts of both structures are darkly pigmented. In the mature apothecia of P.melanophthalma, short hyphae grow inwards from the excipulum and upper parts of the hyphal strands (Figs. 31, 33). Structurally these apothecia closely match those of Phyliscidium monophyllum (Krpsh.) Forss. (Henssen, 1979, Abb. 2i; Henssen & Büdel, 1984a, Plate 8E). In contrast to those of P.melanophthalma and P.submersa, apothecia of P.convexa have constricted bases, similar to those of P.atra (Figs. 23, 28, 29, 33). The phycobiont in P.submersa is probably a species of the Chroococcales. The algal cells are very small and the gelatinous sheath is difficult to recognize. In the other two South African Pterygiopsis-species the phycobiont might be a member of the Pleurocapsales. Species of Chroococcidiopsis and Myxosarcina, have recently been recognized as phycobionts in some genera of the Lichinaceae (Büdel & Henssen, 1983, Henssen & Büdel, 1984b) and proved to be the symbiotic alga in other lichen genera.

The new South African species of Pterygiopsis differ considerably from one another in relation to the habit of the thallus. P.submersa forms orbicular thalli which are zonated or surrounded by a prothallus (Figs. 6, 6a, 7). In P.melanophthalma the thallus is areolate (Figs. 9, 10), and in P.convexa the lobes are scattered and might be effigurate at the margin (Figs. 4,5). In terms of

Figs. 29-33. Anatomy of Pterygiopsis species. Figs. 29-30. P.submersa (holotype). 29. L.s. of apothecium, hymenium divided by hyphal strand. 30. Apothecial primordium with spirally coiled ascogonia (arrows). Figs. 31-33. P.melanophthalma (Henssen 28392a). 31. Marginal part of apothecium with well developed excipulum. 32. T.s. of thallus. 33. L.s. of apothecium, hymenium divided by a hyphal strand, excipulum (e) and sterile part of hymenium darkly pigmented. Fig. 34. Thyrea rotundata. L.s. of thallus including primordium composed of generative tissue with spirally coiled ascogonia (as) and pycnidium (py). Scale = 20 μ m.

their ecology, the three new species are quite unlike. Pterygiopsis submersa was found submersed in a waterfall stream, P.melanophthalma occurred on seepage rocks and P.convexa was collected along the rim of a rock pool. The characteristic attachment base observed in P.atra (Henssen, 1979, Abb. 10E) was just as prominently developed in P.submersa (Figs. 27, 28, 30). In contrast to all other species of Pterygiopsis thus far known, only P.submersa is surrounded by a prominent prothallus (Figs. 6, 6a).

**Key to Pterygiopsis species occurring
in Transvaal**

1. Thallus with prominent prothallus or zonated, growing submersed, hymenium non-amyloid.....P.submersa
1. Thallus without a prominent prothallus and is not zonated, lichen not growing submersed, hymenium amyloid.....2
2. Thallus composed of scattered lobes, apothecia constricted at the base, hymenial gelatine blue in iodine.....P.convexa
2. Thallus areolate, apothecia not constricted at the base, discs strikingly black when moist, hymenial gelatine wine-red in iodine.....P.melanophthalma

**Pterygiopsis convexa Henssen, Büdel et Wessels
sp. nov.**

Figs. 4, 5, 23-26, 42-44.

DIAGNOSIS. Thallus crustaceus, areolo-lobatus, pro parte effiguratus, nigricans, usque ad 6 cm latus, strato gelatinoso substrato affixus. Areolae dispersae vel aggregatae, convexae 0.15-0.3 µm vel elongatae usque ad 0.35 mm. Hyphae radiantes, 2-6 µm crassae. Apothecia (juvenilia) pseudoangiocarpa, ad 0.3 mm lata, basi constricta, margine thallino circumdata. Hymenium 120 µm altum, in iodo caerulescens, subhymenium 45-50 µm altum. Asci cylindracei vel obclavati, 70 x 12-15 µm, 2-8 spori. Sporae eseptatae, incolores, el-

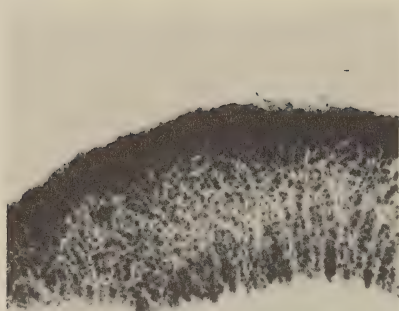
lipsoideae, 8-15 x 6-7 μm . Paraphyses simplices vel sparsim ramosae. Pycnidia ad 0.3 mm lata, adnata, basi constricta, margine thallino circumdata. Conidia bacilliformia, terminaliter formata, 2.5-3.5 x 1 μm . Alga ad ordo Chroococcales vel Pleurocapsales pertinens.

Holotype: Republic of South Africa, Northern Transvaal, Willie's Poort 2229DD, Mutamba, alongside the road to Messina, on sandstone along the rim of a rockpool, c. 660 m, 1982, Henssen & Wessels 28342g (MB) (isotypes: BM, PRE, UPS).

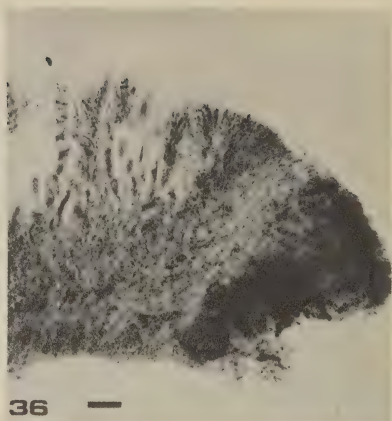
Thallus crustose, 1 to 6 cm broad, blackish, in part effigurate, composed of more or less scattered lobes, closely attached to the substrate. Lobes of irregular shape, 0.15-0.3 mm broad or up to 0.35 mm when elongated. Thallus in sections 120-150 μm high. Hyphae anticlinally arranged, 2-4 μm thick or enlarged to 6 μm when roundish in shape, 2 μm thick in the gelatinose attachmend base which might be well developed and 45(-120) μm high. Phycobiont a member of the order Chroococcales or Pleurocapsales. Algal cells 2-5(-6) μm wide, mostly in groups of 2 or 4 cells, distributed throughout the thallus, frequently attacked by fungal haustoria.

Apothecia (only immature ones seen) to 0.3 mm wide, pseudoangiocarpous, constricted at the base (Fig. 23), with thick thalline margin. Hymenium 120 μm high, gelatine blue in iodine. Asci cylindrical or obclavate (Fig. 24), 70 x 12-15 μm , usually containing less than 8 spores. Spores simple, hyaline, ellipsoid, 8-15 x 6-7 μm (immature). Paraphyses simple or sparsely branched, with cylindrical, slightly vacuolated cells, 1-2 μm thick. Pycnidia adnate, to 0.3 mm broad and then constricted at the base. Conidia rod-shaped, 2.5-3.5 x 1 μm , terminally produced.

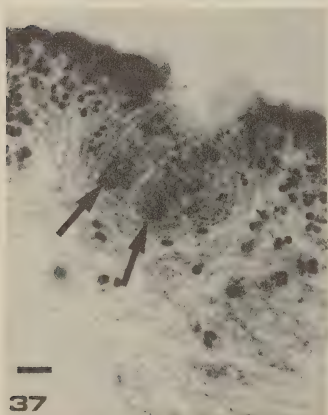
Ecology and distribution. Pterygiopsis convexa was collected on a cave sandstone koppie where it occurred along the upper edge of a rock pool, which was dry at the time of collecting. The koppie is situated in the Mopaniveld (Acocks, 1975). Rainfall averages 300 mm yr⁻¹. The lichen was associated with Peltula clavata (Krph.) Wetm.



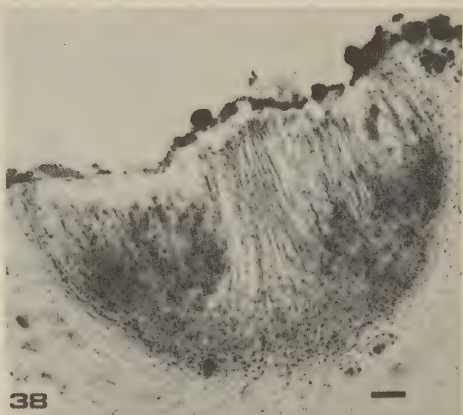
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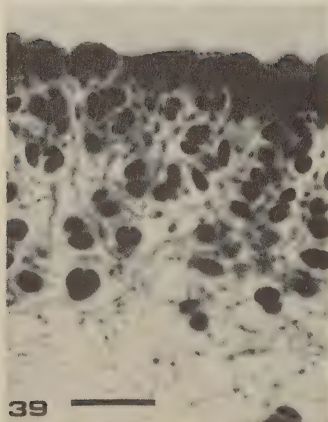
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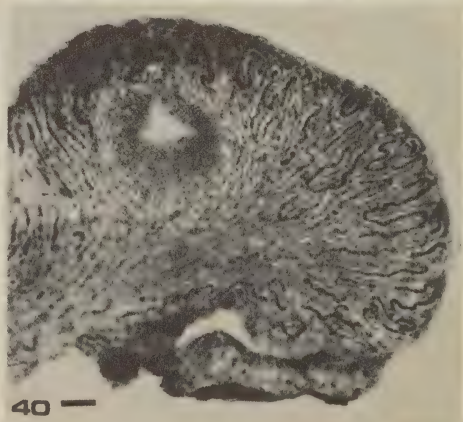
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which grew amongst different species of Peltula and an undescribed species of Synalissa. The lichen is known only from the type locality.

The name "convexa" was chosen to emphasize the convex shape of the lobes in this species.

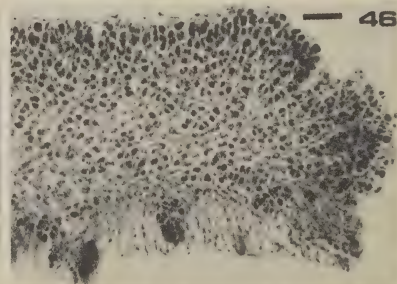
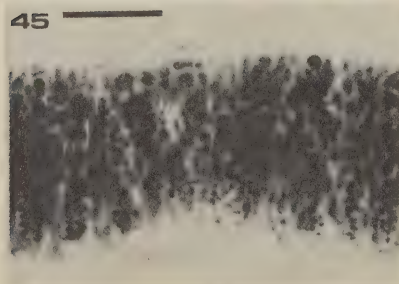
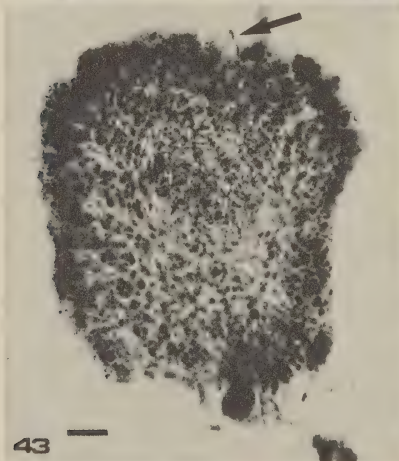
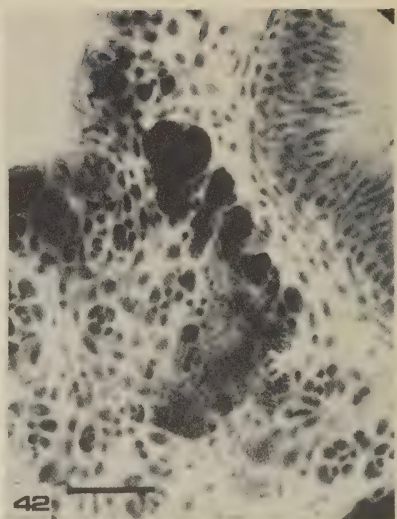
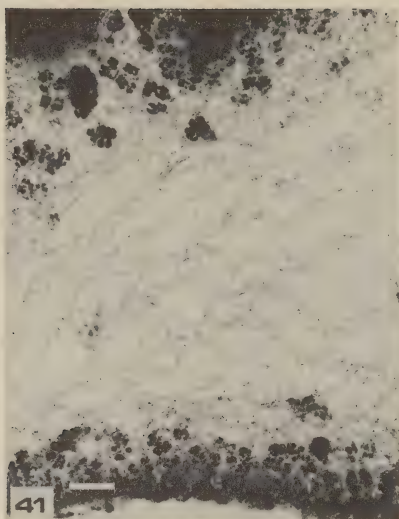
Remarks. Of the three species described here, Pterygiopsis convexa shows a large degree of similarity to P. atra. Both species are distinctly placoid and, at least in part, effigurate. Very large pycnidia which can be easily mistaken for young apothecia may occur in both species. P. convexa differs from P. atra mainly by the presence of more scattered convex lobes (Figs. 4, 5). The collection only contained immature ascocarps with still punctiform discs. The presence of blue-green aglal filaments inside the hymenium of the globose apothecia (Figs. 25, 42) was one of the outstanding features of the species. It is assumed that these algae use the apothecial cavity as a shelter against the unfavourable environmental conditions.

Pterygiopsis melanophthalma Henssen, Büdel et Wessels, sp. nov.

Figs. 8-10, 31-33, 35, 36.

DIAGNOSIS. Thallus crustaceus indistincte limitatus, areolatus, ad 10 cm latus, nigricans, strato gelatinoso substrato affixus. Areolae angulares, 0.1-0.4(-0.65) mm. Hyphae radiantes, 2-5 μ m crassae. Apothecia immersa vel elevata, usque ad 0.5 mm, margine thallino circumdata. Hymenium 95-120 μ m altum, in iodo vinosum, subhymenium 45-50 μ m altum. Asci cylindracei vel obclavati, 70 x

Figs. 35-36. Pterygiopsis melanophthalma (holotype). 35. T.s. of thallus, basal attachment relatively indistinct. 36. L.s. of apothecium with divided hymenium. Figs. 37-39. Thyrea rotundata (holotype). 37. Primordium of apothecium with coiled ascogonia in generative tissue (arrows). 38. Divided hymenium. 39. Anatomy of thallus margin. Fig. 40. Porocyphus effiguratus (Büdel 14036c). L.s. of thallus and enclosed pycnidium. Scale = 20 μ m.



12-13 μm , octospori. Sporae eseptatae, incolores, ellipsoideae, 12-18 x 5-9.5 μm . Paraphyses ramosae, 1.5-2 μm crassae. Pycnidia immersa, ad 0.5 mm lata, conidia bacilliformia, 2.5-3 x c.1 μm . Alga ad ordo Chroococcales vel Pleurocapsales pertinet.

Holotype. Republic of South Africa, Eastern Transvaal, Graskop 2430DD, Panorama Falls, Look-out Point, on seepage sites of hard sandstone rocks, c. 1400 m, 1982, Henssen & Wessels 28405b (MB) (isotype: PRE); additional collection from the same site: Henssen no. 28392a (MB).

Thallus crustose, areolate, irregular in shape, blackish, up to 10 cm in diameter, closely attached to the substrate. Areoles angular, 0.1-0.45 or 0.4-0.65 mm when fertile, closely aggregated. Thallus in sections 115-120 μm high, attached base more or less indistinct. Hyphae anticlinally arranged, cells cylindrical and c. 2 μm thick or enlarged and roundish to 5 μm thick and vacuolated. Phycobiont a member of the order Chroococcales or Pleurocapsales. Alagel cells 2.5-5 μm , single or in groups of 2 (-4), distributed throughout the thallus.

Apothecia immersed or slightly elevated and surrounded by a thalline margin, up to 0.5 mm wide, disc conspicuously black when moist (Figs. 8-10). Hymenium 95-120 μm high, multiply divided by hyphal strands, columns darkly pigmented at the surface. Hymenial gelatine initially blue, later turning wine-red with iodine. Subhymenium 45-50

Figs. 41-46. Anatomy of Thyrea and Pterygiopsis species. Fig 41. T. rotundata (holotype). L.s. of thallus, the hyphae arranged in a netted pattern. Figs. 42-44. P. convexa (holotype). 42. Lichen thallus penetrated by different species of blue-green algae (arrows). 43. Ascocarp primordium with protruding trichogyne (arrow). 44. T.s. of a large pycnidium. Fig. 45. P. submersa (holotype). L.s. of the prothallus, cells of the phycobiont darkly stained. Fig. 46. P. atra (isotype: TUR). L.s. of thallus with well developed attachment base. Scale in 41 = 50 μm , in 42-46 = 20 μm .

μm . Only the upper part of the excipulum is well developed, 40-50 μm wide and on the surface darkly pigmented. Paraphyses branched, short-celled, 1.5-2 μm thick, short paraphyses developing from the upper part of the excipulum and hyphal columns (Fig. 31). Asci cylindrical or obclavate, 70 x 12-13 μm (immature), containing 8 spores. Spores simple, hyaline, ellipsoid to subglobose, 12-18 x 5-9.5 μm . Pycnidia immersed, up to 0.5 mm wide, opening by means of fissures. Conidia rod-shaped, 2.5-3 x 1 μm , produced terminally.

Ecology and distribution. Pterygiopsis melanophthalma was found on seepage plates at the locality described in detail under Lichina macrospora, P. melanophthalma was frequently overgrown by the latter species. Other lichens associated with P. melanophthalma were undescribed species of Pyrenopsis, together with Peltula clavata and P. lingulata (Vain.) Swinsc. & Krog. The lichen is known only from the type locality.

The name "melanophthalma" is chosen to emphasize the conspicuous black colour of the apothecial disc under moist conditions.

Remarks. Pterygiopsis melanophthalma is characterized by a uniform areolate thallus which is never effigurate, the partly immersed apothecia and the multiply divided hymenium. The species is easily distinguished from the other two South African species by the forementioned characteristics, but in particular by the black colour of the discs under moist conditions.

**Pterygiopsis submersa Büdel, Henssen et Wessels
sp. nov.**

Figs. 6-7, 27-30, 45.

DIAGNOSIS. Thallus crustaceus, orbicularis, umbrinus, zonatus, in statu juvenile prothallo circumdatus, usque ad 4 cm latus, strato gelatinoso substrato affixus. Areolae angulares, 0.25-0.45 mm latae. Hyphae radiantes, 1-3 μm crassae. Apothecia pseudoangiocarpa, usque ad 0.5 mm lata cum margine thallino. Hymenium 160-180 μm altum, non amyloideum. Paraphyses ramosae et anastomosantes, 2 μm crassae. Asci cylindraceae vel obclavati,

60-80 x 5-8 μm , 3-4 spori. Sporae eseptatae, incolores, ellipsoideae, 9.5-14 x 7 μm . Pycnidia immersa, 60 μm lata. Conidia ellipsoideo-fusiformia, 3 x 1 μm . Alga ad ordo Chroococcales perti-nens.

Holotypus. Republic of South Africa, Northern Transvaal, Tzaneen 2330CC, De Hoek State Forest, Debengeni Fall, on granite plates covered by running water, c. 1200 m, 1983, Büdel & Wessels 14036a (MB) (isotype: PRE).

Thallus crustose, orbicular, brownish, zonate, cracky areolate, up to 4 cm broad, closely attached to the substrate. Juvenile thalli surrounded by an ochraceus, pseudoparenchymatous prothallus, up to 0.5 mm wide. Areoles angular, 0.25 -0.45 mm, at the thallus margin in part elongated, up to 0.65 mm. Thallus in sections 100-25 μm high with distinct attachment base along the lower third. Hyphae anticlinally arranged, 1-3 μm thick, cells short or elongated, in prothallus enlarged to 4.5 μm , in attachment base embedded in gelatinous matrix and at first reticulately orientated. Phycobiont a member of Chroococcales. Algal cells 2-4.5 μm , rarely penetrated by haustoria, distributed throughout the thallus.

Apothecia numerous, up to 0.5 mm wide, with thalline margin, juvenile stages immersed, adnate in later stages, disc up to 0.3 mm broad, circular or angular, frequently umbonate or hymenium washed out and apothecia then urceolate. Hymenium 160-180 μm high, in later stages divided by a hyphal strand forming a column 25-30 μm wide in the upper part. Hymenial gelatine does not stain in iodine. Subhymenium 20-30 μm . Paraphyses richly branched and anastomosing, c. 2 μm broad. Hyphal strands and excipulum darkly pigmented at the surface. Thalline margin 40-60 μm thick. Asci cylindrical to obclavate, 60-80 x 5-8 μm (immature) containing less than 8 spores. Spores 9.5-14 x 7 μm (immature). Pycnidia immersed, in sections c. 60 μm , conidia elliptic-fusiform, 3 x 1 μm .

Ecology and distribution. Pterygiopsis submersa occurred on hard granite plates where it was per-

manently inundated by a shallow stream of water. It was associated with Porocyphus effiguratus Henssen. The lichen was overgrowing a species of Hildenbrandia, which covered the whole site. The site receives shade early in the afternoon. The De Hoek State Forest is a tropical forest type (Acocks, 1975). The area has a summer rainfall with an average of 1757 mm yr^{-1} (Strydom, Forester of the De Hoek State Forest, personal communications), fog frequently occurs.

The name "submersa" is chosen to emphasize the habitat of the new species.

Remarks. The thallus of Pterygiopsis submersa varies considerably. In juvenile stages the ochraceous prothallus is very distinct (Fig. 6a), 45-50 μm thick, the pseudoparenchyma is composed of strongly adglutinated, anticlinally arranged hyphae which might include a few algal cells. Irregularly shaped patches of thalli develop on the surface of the prothallus, which become closely aggregated during further development. During later stages, the prothallus gradually disappears, and the thallus becomes zoned by a 1 to 1.5 mm broad, blackish zone. This zone lacks fruiting structures and is slightly elevated along the margin (Figs. 6, 7). The prothallus of P. submersa is of special interest in that it is pseudoparenchymatous instead of being plectenchymatous, as in other lichens, e.g. in species of Placynthium and in members of the Pannariaceae. Most of the apothecia in the type specimen were either immature or very old without a hymenium (Fig. 7). The measurements of the asci and spores must therefore be considered as precursory. Pycnidia were rarely observed in well developed thalli, but were noticed in the prothalli of juvenile stages. As far as is known, P. submersa is the only member of the genus to grow under submersed conditions and to have a distinct prothallus and zonation (Figs. 6, 6a, 7). These distinct characteristics clearly separate P. submersa from the other South African species. The structure of the apothecia of P. submersa closely resembles that of P. melanophthalma. The two species seem to be closely related.

3. A new species of Thyrea

Thyrea rotundata Büdel, Henssen et Wessels sp. nov.

Figs. 11-13, 34, 37-39, 41.

DIAGNOSIS. Thallus rosulatus, nigricans, umbilico-lobatus, usque ad 11 mm latus. Lobi applanati, sparsim ramosi, 1-4 mm longi et 1-1.5 mm lati. Thallus umbilico affixus. Hyphae centrales reticulum regulare formantes, 1.5-2.5 μ m crassi. Hyphae ad marginem 4.5 μ m crassae. Alga ad ordinem aut Chroococcales aut Pleurocapsales pertinens. Cellulae algarum 4.5-6 x 8-10 μ m latae. Apothecia laminalia, primo immersa deinde elevata, in sectione 280 μ m lata. Hymenium saepe divisum, 130-190 μ m altum, in iodo caerulescens. Paraphyses 1.5-2 μ m crassae. Asci clavati, c. 60 x 10 μ m, 3-4spori. Sporae eseptatae, incolores, ellipsoideae, c. 12 x 7 μ m. Pycnidia immersa vel modice elevata. Conidia bacilliformia, 1.5 x 3 μ m lata.

Holotype: Republic of South Africa, Eastern Transvaal, Mogaba 2430DA, Kaspersnek, 30°42'30"E, 24°43'50"S, at 1280 m, in seepage lines of volcanic rock outcrops. West north westerly facing side of the mountain which forms part of a river valley. Collectionsite 100 m from a river and is situated in the North-Eastern Mountain Sourveld (Acocks, 1975). 1983, Büdel & Wessels 14038a (MB) (isotype: PRE; further isotypes will be distributed in Henssen, Lichenes cyanophili exsiccati).

Thallus rosette-shaped, umbilicate, up to 11 mm in diameter, branched into flattened lobes, blackish when dry, olive coloured when wet. Lobes 1-4 mm long and 1-1.5 mm wide, sparsely branched, rounded at the tips. Upper surface rough except for the lobe tips which are more or less smooth, darker in colour (Fig. 11) and shiny during the wet stage. Lower surface furrowed. Holdfast irregularly round (Fig. 12), c. 1mm wide, composed of anticlinally arranged hyphae. Thallus in sections 650-750 μ m thick. Hyphae in the central part 1.5-2.5 μ m thick, loosely interwoven giving rise to a netted pattern (Fig. 41). Hyphae towards the thallus margin anticlinally orientated,

forming a network, cells sphaerical to angular in shape and up to $4.5\ \mu\text{m}$ thick (Fig. 39). Phycobiont a member of the order Chroococcales or Pleurocapsales, algal cells $4.5\text{--}6 \times 8\text{--}10\ \mu\text{m}$, arranged in packets of 2 to 8, usually 4 cells, each cell penetrated by a haustorium.

Apothecia very rare, laminal, pseudoangiocarpous, with talline margin, immersed or slightly protruding, disc $0.02\ \text{mm}$ in diameter. Apothecia in sections $280\ \mu\text{m}$ wide. Ascocarp develops from hyphal web of generative tissue (Fig. 37). The upper part of a primordium might in addition contain a pycnidium (Fig. 34). Hymenium sometimes divided (Fig. 38), $130\text{--}190\ \mu\text{m}$, gelatine staining blue in iodine. Asci clavate, c. $60 \times 10\ \mu\text{m}$ (immature), containing less than 8 spores (3 or 4). Spores simple, hyaline, ellipsoid, c. $12 \times 7\ \mu\text{m}$. Secondary (true) paraphyses $1.5\text{--}2\ \mu\text{m}$ thick, cells irregular in length. Pycnidia laminal, immersed or slightly protruding, in sections $150\text{--}350\ \mu\text{m}$ broad, conidia terminally produced, rod-shaped, $1.5 \times 3\ \mu\text{m}$.

Ecology and distribution. Thyrea rotundata occurs on rocks of volcanic origin. The thalli were found growing in rock crevices and on flat parts of the rock. Because of the west north westerly exposure of the site it is representative of a hot, dry habitat. The thalli are moistened only during the rainy season and afterwards during relatively short periods when the seepage streams are actively running. The lichen is known only from the type locality.

The name "rotundata" was chosen to emphasize the roundish lobe tips characteristic for this species.

Remarks. T. rotundata is closely related to T. polyglossa Nyl. from Cuba and to undescribed species which occur in similar habitats in East Africa or Mexico respectively. The species form a distinct section within the genus Thyrea. The taxonomy of the aforementioned species which will be discussed in a forthcoming paper.

4. A second locality for Porocyphus effiguratus

Porocyphus effiguratus was until now only known from the type locality in Zimbabwe (Henssen, 1974). The new material was collected by Büdel & Wessels during 1983 (no. 14036c). A description of the site can be found under Pterygiopsis submersa (see above) with which it was associated.

The internal and external morphology of the new collection closely resembles that of the type specimen. Other than the type specimen which was only an old thallus, several stages of thallus development are present in the specimen from the Transvaal (Figs. 14, 15).

The fan-shaped arrangement of the thallus hyphae in Porocyphus effiguratus resembles the anatomy of Pterygiopsis species (Fig. 40). The apothecia are pycnoascocarps, a characteristic which is not associated with Pterygiopsis.

ACKNOWLEDGEMENTS

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ZUSAMMENFASSUNG

Es werden fünf neue Arten der Lichinaceen von Nordost-Transvaal beschrieben. Lichina macrospora Henssen, Büdel & Wessels ist eine nicht-marine Art und gehört zur L. willeyi-Gruppe mit aufrechten, drehrunden Loben, die interkalar und terminal Pycnoascocarpien tragen und bei denen die Fäden der symbiotischen Dichothrix-Alge aus dem Lager ausragen können.

Der Thallus von Pterygiopsis convexa Henssen, Büdel & Wessels besteht aus zerstreuten bis zu-

sammenhängenden Loben und ist teils am Rande efiguriert. Von der Typusart, P. atra, mit ähnlich placoidem Lager und Fruchtkörperbau unterscheidet sich P. convexa durch die kleineren und konvexen Loben. Pterygiopsis melanophthalma Henssen, Büdel & Wessels ist durch ein gleichmäßig areoliertes Lager und durch beim Anfeuchten auffällig schwarze Apothecienscheiben gekennzeichnet. Pterygiopsis submersa Büdel, Henssen & Wessels ist die einzige bisher bekannte Art der Gattung mit zoniertem Lager und einem Prothallus im Jugendstadium sowie submersen Standort. Bei P. melanophthalma und P. submersa ist das Hymenium durch Hyphenstränge unterteilt, die Scheiben sind entsprechend umbonat oder uneben.

Thyrea rotundata Büdel, Henssen & Wessels hat ein rosettiges Lager mit flachen, an den Spitzen abgerundeten Loben. Die Hyphen bilden ein regelmäßiges Maschennetz, teils ein Rautenmuster. Die Apothecien sind Pycnoascocarprien.

Porocyphus effiguratus Henssen wird als neu für Südafrika angegeben. Die Flechte war bisher nur aus Zimbabwe bekannt.

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NEW SPECIES OF FUNGI FROM INDONESIAN DRIED FISH

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Abstract

Polypaecilum pisce, Penicillium chalybeum, Penicillium corynephorum and Penicillium patens are described from Indonesian dried fish. Basipetospora halophila (van Beyma) Pitt & Hocking comb. nov., synonym Scopulariopsis halophilica Tubaki, is also described.

Introduction

During a study of fungal spoilage of dried fish from Indonesian sources, several interesting fungi were encountered. The most significant spoilage organisms were an undescribed Polypaecilum species and the halophilic fungus commonly known as Scopulariopsis halophilica Tubaki. Studies in this laboratory several years ago showed that S. halophilica was conspecific with Oospora halophila van Beyma 1933; more recent work by us using scanning electron microscopy has shown that it is not a Scopulariopsis but a species of Basipetospora Cole and Kendrick. These two fungi are described below, together with three new Penicillium species isolated from the same source.

Methods

For the Penicillium species, the methods, media and plating regime described by Pitt (1979) have been followed, i.e. cultures have been incubated for 7 days on Czapek yeast autolysate agar (CYA) at 5, 25 and 37°; and malt extract agar (MEA) and 25% glycerol nitrate agar (G25N) at 25°. For the Polypaecilum species, these three media were used at 25°, and also malt yeast 50% glucose agar (MY50G), a medium suitable for the majority of xerophilic fungi (Pitt and Hocking, 1982) and malt yeast 5% salt 12% glucose agar (MY5-12), a newly formulated medium suitable for halophilic fungi. MY50G has the following formulation: malt extract, 2.0%; yeast extract, 0.5%; glucose, A.R., 50% (w/w); agar, 2.0%. MY5-12 contains the following ingredients: malt extract, 2.0%; yeast extract, 0.5%; NaCl, A.R., 5% (w/v); glucose, 12% (w/v); agar, 1.5%. MY5-12 has a water activity of 0.93 and should be sterilised by autoclaving; MY50G, of water activity 0.89, can be effectively sterilised by steaming at 100° for 30 min.

Capitalised names of colours used in the following descriptions are from the "Methuen Handbook of Colour" (Kornerup and Wanscher, 1978).

Basipetospora halophila cultures were incubated at 25° on the same media as were used for Polypaecilum. Also included as more suited to this fungus was a medium of higher salt concentration, malt yeast 10% salt 12% glucose agar (MY10-12). This medium is formulated in a similar way to MY5-12, but contains 10% (w/v) NaCl. It has a water activity of 0.88, and should be sterilised by heating at 100°.

Basipetospora halophila (van Beyma) Pitt & Hocking, comb. nov.

Fig. 1

Basionym: Oospora halophila van Beyma, Zentbl. Bakt. ParasitKde, Abt II, 88: 134 (1933).
 Synonym: Scopulariopsis halophilica Tubaki, Trans. Mycol. Soc. Japan 14: 367 (1973).

On CYA or MEA at 25°, 14 days, no growth.

On G25N, 25°, 14 days, colonies 4-8 mm diam, occasionally 12 mm, of dense and tough mycelium, centrally raised, sulcate or irregularly wrinkled; margins entire, narrow; mycelium persistently white, with little or no sporulation; reverse pale.

On MY50G, 25°, 14 days, colonies 4-8 mm diam, similar to those on G25N.

On MY5-12, 25°, 14 days, colonies 10-16 mm diam, low or umbonate, plane or irregularly wrinkled, of dense mycelium overlaid by floccose to funiculose aerial hyphae; mycelium persistently white, sporulation light to moderate in lower layers of the mycelium; reverse pale to yellow brown.

On MY10-12, 25°, 14 days, colonies 18-22 mm diam, similar to those on MY5-12, but growth more rapid and vigorous; sporulation in surface mycelial layers moderate to heavy; mycelium and conidia persistently white; reverse pale to yellow brown.

Reproductive structures short, solitary conidiophores borne at irregular intervals along vegetative hyphae, sometimes bearing a short chain of conidia, but more commonly a single developing conidium, shed at maturity and succeeded by another blown out terminally from the conidiophore, the conidiophore shortening a little with successive conidia; conidiophores often curved, usually cylindrical, 2.0-3.0 µm diam, but sometimes narrowing towards the apex; when young 8-20 µm long, in age down to 3-4 µm long, smooth walled; mature conidia spherical to broadly ellipsoidal or pyriform with a truncate base, 3.5-6.0 µm diam, with heavy walls, smooth to finely roughened, in wet mounts usually solitary, but sometimes in chains of 3 or 4. No teleomorph known to be produced.

Typification. CBS 232.32, van Beyma's original isolate, is type.

Taxonomy. This distinctive species was described as Oospora halophila by van Beyma (1933) and catalogues of the Centraalbureau voor Schimmelcultures have more recently recorded two further isolations. The name has not been used by later authors, however, and the genus Oospora was rejected as illegitimate by Hughes (1958). Tubaki (1973) described Scopulariopsis halophilica in terms which did not lead to association with van Beyma's species. Several years ago, as part of our studies on xerophilic fungi, the CBS isolates of Oospora halophila were obtained and recognised as being synonymous with the type of S. halophilica. Subsequent studies of S. halophilica by scanning electron microscopy (SEM) showed it was not a Scopulariopsis, and isolation of several fresh isolates of this species from Indonesian fish has prompted publication of the new combination.

Under light microscopy, conidiophores sometimes narrow towards the apices, and bear a remarkable resemblance to solitary phialides or annelides (Fig. 1B). However, study of the development of the conidia by light microscopy and SEM showed clearly that the conidiophores are not annelides but produce conidia by the meristematic elongation characteristic of Basipetospora (Cole and Kendrick, 1968; Cole and Samson, 1979; Figs. 5-25 to 5-29). Figs 1E to 1G show that each successive conidium is blown out from the tip of the conidiophore without elongation at that point, after a septum is laid down. When conidia do not secede (Fig. 1D, 1G), the developing structure is strikingly similar to that published by Cole and Kendrick (1968) for Basipetospora rubra.

The differences in rates of growth of this fungus on MY50G and MY5-12, media of similar water activity and nutritional status, show clearly that growth is much more rapid in the presence of sodium chloride. It is concluded that this species is a true halophile, unlike other previously described



Fig. 1. *Basipetospora halophila*. A, colonies on MY5-12 and MY10-12 agars, 14 days at 25°; B-D, conidiophores and conidia, Nomarski interference contrast light microscopy, X1875; E-G, conidiophores and conidia, scanning electron microscopy, E, X4000, F,G, X5000.

"halophilic" fungi, which are relatively indifferent to solute type at low water activities (Pitt, 1975). Studies on the water relations of this species will be published elsewhere (Andrews and Pitt, in preparation).

Isolates examined: FRR 2425 (CBS 232.32), ex type of *Oospora halophila*, from salt crystal, Utah, U.S.A., 1932, F.H. van Beyma; FRR 2184 (= IFO 9650, IMI 184617, CBS 380.74, ATCC 42877), ex type of *Scopulariopsis halophila*, from salted (dried) seaweed, *Undaria pinnatifida*, Osaka, Japan, 1971, M. Baba; FRR 2187, from imported Asian dried fish, Sydney, N.S.W., Australia, 1979, A. D. Hocking; FRR 2426 (CBS 141.40), from dried cod, ca 1940, J.F.W. Holtz; FRR 2427 (CBS 348.68), from salt fish, 1960, at CBS; FRR 2608, from dried Japanese fish, Sydney, N.S.W., Australia, 1984, S. Andrews; FRR 2609, from gelatine hydrolysate, Japan, T. Awao; FRR 2611, from indigo solution for batik dyeing, Japan, S. Udagawa; FRR 2787, from *Saurida* sp., 1984, K. A. Wheeler.

Polypaecilum pisce Hocking & Pitt, sp. nov.

Fig. 2

In agar MY5-12 coloniae veteres duarum hebdomadam 35-45 mm diam radiante sulcatae vel irregulariter caperatae et elevatae ad centri; humiles densae et velutinae vel rudimentariis fasciculis vel bene evolutis funiculis; mycelium album; conidiogenesis profusa, alba; reverso pallido vel bubalino. Reproductivae structurae polyphialides portatae singulariter super conidiophoris ex vegetativis hyphis; polyphialides profusae corporibus 15-60 x 3-5 μ m parietibus tenuis levibus inramosis vel dichotome vel irregulariter ramoses prope apices, unusquisque ramus 2-5 collulis 3.0-5.0 x 2.0-2.5 μ m; conidia ellipsoidea vel limoniforma 5-8 x 3.5-4.0 μ m, hyalina parietibus levibus portatis in columnis longis.

Typus: FRR 2732, ex pisce sicca Java, Sydney, Novo Wallio Australi, 1984, K. A. Wheeler.

Etym.: Latin *pisce* = from a fish.

On CYA and MEA, 25°, 14 days, colonies usually low and sparse, sometimes centrally umbonate or irregularly wrinkled, with a dense, velutinous or weakly funiculose texture; margins entire or fimbriate; sporulation light, mycelium and conidia persistently white; on CYA, sclerotia formed by a few isolates, white to buff, 250-400 μ m diam, with walls of pseudoparenchymatous cells, becoming firm at maturity; reverse pale to yellow brown.

On G25N, 25°, 14 days, colonies low and sparse, often deeply and irregularly wrinkled centrally, texture usually velutinous, sometimes floccose or funiculose centrally; margins often irregular or fimbriate; mycelium persistently white; conidia sparsely produced, uncoloured; exudate and soluble pigment not produced; reverse pale.

On MY50G, 25°, 14 days, colonies 10-18 mm diam, plane and sparse, margins entire, velutinous to floccose, heavily sporing; mycelium and conidia persistently white; exudate and soluble pigment absent; reverse pale.

On MY5-12, 25°, 14 days, colonies developing more vigorously than on other media tested, 35-45 mm diam, radially sulcate or irregularly wrinkled and often centrally raised; some isolates with growth low, dense and velutinous, others with rudimentary fascicles bearing conidial structures terminally, or sometimes with quite well developed funicles, up to 1 mm high, with scattered conidial structures; conidial structures borne in profusion, mostly terminal on ascending or trailing hyphae, each bearing several short chains of conidia clearly visible under the low power microscope; mycelium and conidia persistently white; exudate and soluble pigment not produced; reverse pale to buff.

Reproductive structures polyphialides, borne solitarily on short conidiophores from vegetative hyphae; polyphialides large and complex, with a body 15-60 μ m long and of varying width, usually 3-5 μ m, with thin, smooth walls, unbranched or more commonly dichotomously or irregularly branched near the apex, each branch terminating in 2-5 necks, 3.0-5.0 x 2.0-2.5 μ m, each bearing conidia; conidia ellipsoidal to limoniform, 5-8 x 3.5-4.0 μ m, hyaline, smooth walled, borne in long chains, breaking up in wet mounts.

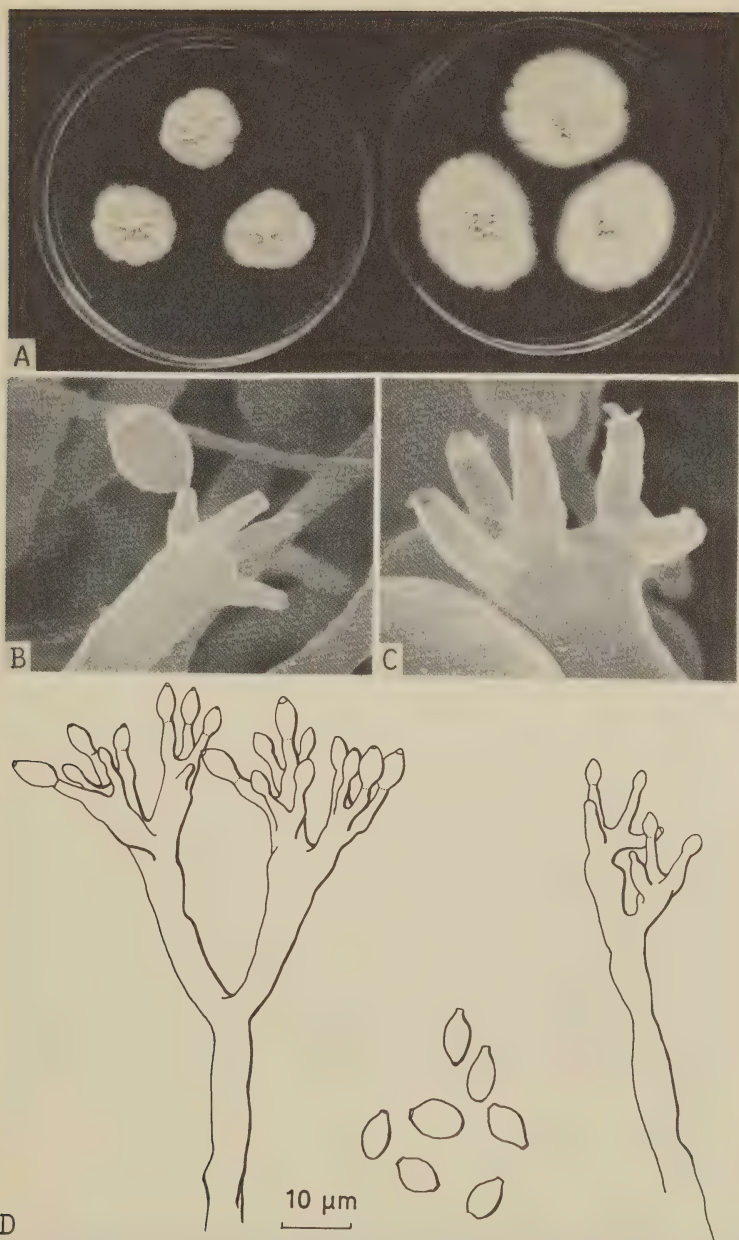


Fig. 2. *Polypaecilum pisce*. A, colonies on G25N and MY5-12 agars, 14 days, 25°; B-C, polyphialide necks and conidium, SEM, B, X2500, C, X5000; D, upper portions of polyphialides.

Typification. The herbarium specimen FRR 2732 is designated as holotype of Polypaecilum pisce. It was isolated from Indonesian dried fish, Ophiocephalus striatus, Sydney, N.S.W., Australia, 1984, K. A. Wheeler. A culture from the type isolate has been accessioned by the Commonwealth Mycological Institute (CMI) as IMI 288726, and the American Type Culture Collection (ATCC) as ATCC 56982.

Taxonomy. This species produces conidia from polyphialides and belongs in the genus Polypaecilum G. Smith. In erecting this genus, Smith (1961) stated that the reproductive structures were annellophores, but more recent reports have indicated that the conidiogenous structures characteristic of this genus are polyphialides (Cole and Samson, 1979: 69).

Other species in this genus, Polypaecilum insolitum G. Smith and P. capsici (van Beyma) G. Smith, have not been reported to grow on media of reduced water activity. A close relationship to the new species is therefore doubtful.

Occurrence. Polypaecilum pisce appears to be a major cause of spoilage of dried fish in Indonesia, samples showing a profuse white growth being not uncommon in our experience. This species has been isolated from 42% of the 31 samples of Indonesian fish so far examined in this study, and 20% showed extensive growth of this fungus. In view of this, it is surprising that it apparently has not been described previously; however, an extensive search of the literature has failed to find a recognisable description. Like Basipetospora halophila, P. pisce is a halophile, growing much more rapidly and vigorously on MY5-12 than on MY50G. Studies on the water relations of this species will be published elsewhere (Andrews and Pitt, in preparation).

Isolates examined were all isolated in Sydney, N.S.W., Australia: FRR 2185, from dried fish commercially imported into Australia from unknown Asian source, 1979, A. D. Hocking; and the following from dried fish imported from Indonesia for mycological studies: FRR 2732, ex type, as detailed above; FRR 2606 (= IMI 288720, ATCC 56981), 1983, S. Andrews; FRR 2607, 1984, J. L. Pitt; FRR 2733 (= IMI 288727, ATCC 56983), from dried squid, Loligo sp., 1984, K. A. Wheeler; FRR 2789, from Katsuwonus sp., 1984, K. A. Wheeler; FRR 2788, from Scomberomonus sp., 1984, K. A. Wheeler; FRR 2791, from Rastrelliger kanagurta, 1984, K. A. Wheeler.

Penicillium corynephorum Pitt & Hocking, sp. nov.

Fig. 3

In agar CYA coloniae veteris unius hebdomadis 32-40 mm diam planae humiles et velutinae vel profunde floccosis superacutis mycelii ad centri; mycelium album floccosis areis vel ad margines primulinis; conidiogenesis moderate turcosa vel glauca; flavida excudata et flava solum pigmentum formati; reverso pallido vel primulino interdum aurantiaco. Conidiophora portata ex hyphis paginis stipites 200-500 x 3.0-4.0 um parietibus levibus vel rugulosis; penicilli biverticillati semper terminales; metulae 10-12 um longae appressae asymmetricae vesiculatae ad apices 4.5-5.5 um diam; phialides ampulliformae 7-9 x 2.0-2.2 um curvae intro collulis brevibus; conidia spherica 2.0-2.5 um diam parietibus levibus portatis in columnis longis.

Typus: Herb. FRR 2663, ex pisce sicca Java, Sydney, Novo Wallio, Australi, 1983, J. I. Pitt.

Etym.: Greek coryne = club plus Latin -phorus = bearing; the epithet refers to the distinctive club-shaped metulae produced by this species.

On CYA, 25°, 7 days, colonies 32-40 mm diam, plane, low and velutinous or with deeply floccose mycelial overgrowths in central areas; margins subsurface; mycelium white in floccose areas, but in marginal areas greenish yellow; conidiogenesis moderate, Greyish Turquoise to Dull Green (24-25E3); pale yellow exudate and bright yellow soluble pigment usually produced; reverse pale to Bright or Greenish Yellow (1-2A-B6), sometimes with orange areas.

On MEA, 25°, 7 days, colonies 45-55 mm diam, plane, low and sparse, velutinous, sometimes with a light floccose overlay; margins subsurface; mycelium conspicuous only in floccose areas, white; conidiogenesis moderate, Dull Green near Cactus Green (28E4); exudate and soluble pigment absent; reverse dull to

bright greenish yellow.

On G25N, 25°, 7 days, colonies 10-15 mm diam, plane, low to moderately deep, dense; mycelium white; conidiogenesis moderate to heavy, Greyish Turquoise (24D-E3); reverse dull to bright greenish yellow.

At 5°, CYA, 7 days, at least germination, sometimes microcolonies formed.

At 37°, CYA, 7 days, usually no growth, occasionally colonies up to 5 mm diam produced.

Conidiophores borne from subsurface hyphae, stipes long and slender, 200-500 x 3.0-4.0 μ m, characteristically swelling to 5-6 μ m diam just below the first septum, i.e. 25-30 μ m from the penicillus, with walls smooth to distinctly roughened, bearing strictly terminal biverticillate penicilli; metulae in closely



Fig. 3. *Penicillium corynephorum*. A, colonies on CYA and MEA, 7 days, 25°; B, C penicilli, X750; D, conidia, X1875.

appressed clusters of 4-6, asymmetrically vesiculate, swollen on the side away from the penicillus axis, fertile from the apex outward over the swollen area, 10-12 μm long, 2 μm diam at the base and 4.5-5.5 μm diam at the apices; phialides ampulliform, slender, 7-9 x 2.0-2.2 μm , inwardly curved in proportion to distance from the penicillus axis, with short collula; conidia spherical, 2.0-2.5 μm diam, smooth walled, borne in long uniform columns, one per stipe.

Typification. The herbarium specimen FRR 2663 is designated as holotype of Penicillium corynephorum. It was isolated from Indonesian dried fish, Decapterus sp., Sydney, N.S.W., Australia, 1983, J. I. Pitt. A culture of the type isolate has been accessioned by CMI as IMI 288724 and ATCC as ATCC 56976.

Distinguishing characteristics. The character of the Penicillium corynephorum penicillus is distinctive: appressed asymmetrically swollen metulae and slender phialides which curve according to distance from the penicillus axis, combine to produce a precisely formed penicillus bearing conidia in long, defined columns. The swelling below the first, and sometimes lower, septa of the stipes is unique in the genus. Bright yellow soluble pigment is usually produced on CYA at 25°.

Taxonomic position. In the classification of Pitt (1979), Penicillium corynephorum belongs in subgen. Furcatum. In the key to that subgenus (Pitt, 1979: 237) it will key out to couplet 26 along with P. novae-zeelandiae and P. raistrickii. It shows obvious affinities with these two species, but is readily distinguished by the absence of sclerotia and by the other characters listed above.

Isolates examined. Two isolates of this species have been isolated in this laboratory from Indonesian dried fish, FRR 2663, details above, and FRR 2676 (= IMI 288725, ATCC 56977), from Rastrelliger kanagurta, 1984, K. A. Wheeler.

Penicillium chalybeum Pitt & Hocking, sp. nov.

Fig. 4

In agar CYA coloniae veteres unius hebdomadis 42-50 mm diam planae vel irregulariter caperatae humiles moderate densae et velutinae; mycelium inconspicuum album; conidiogenesis moderate turcosa vel glauca; reverso pallido vel helvolo marginibus et centrīs atrovirentibus subinde olivaceis. Conidiophora portata ex hyphis submersis stipites 150-250 x 3.0-4.0 μm parietibus crassis tuberculis; penicilli biverticilloti 2-3 metulis terminalibus vel interdum subterminalibus; metulae 12-25 x 3.0-4.0 μm parietibus asperis apicibus saepe dilatatis; phialides ampulliformes 9-15 x 2.0-2.5 μm ; conidia ellipsoidea 3.0-3.5 x 2.0-3.0 μm parietibus crassis levibus portatis inordinate catenis.

Typus: Herb. FRR 2660, ex pisce sicca Java, Sydney, Novo Wallio, Australi, 1983, J. I. Pitt.

Etym.: Latin chalybeus = steel grey, and here refers to the unusual conidial colour of this species.

On CYA, 25°, 7 days, colonies 42-50 mm diam, plane or irregularly wrinkled, low, moderately dense, strictly velutinous; margins subsurface, fimbriate; mycelium inconspicuous, white; conidiogenesis moderate, in marginal areas Greyish Turquoise (24B-C3), elsewhere Greyish Green (25-26D2); exudate and soluble pigment absent; reverse characteristically pale brown to Golden Brown (5D7) with Dull to Deep Green (26D-F4) margins and central areas, occasionally Olive Brown (4D-F4) or similar colours in all areas.

On MEA, 25°, 7 days, colonies 50-60 mm diam, plane, low and sparse, strictly velutinous; margins subsurface; mycelium subsurface or inconspicuous; conidiogenesis light to moderate, Greenish Grey (25-26D2-3); exudate and soluble pigment absent; reverse pale, pale brown or Greyish Yellow near Wheat (4B5).

On G25N, 25°, 7 days, colonies 12-16 mm diam, plane, moderately dense, velutinous; margins and mycelium subsurface; conidiogenesis moderate, Dull Green near Almond Green (27-28E3); exudate and soluble pigment absent; reverse pale to greenish yellow or brown.

At 5°, CYA, 7 days, at least germination, usually microcolony formation, or barely visible colonies formed.

At 37°, CYA, 7 days, colonies 3-8 mm diam, dense and leathery, wrinkled, coloured brown or greyish if conidia produced; pale yellow soluble pigment usually produced; reverse usually Yellowish Brown (5C-E5).

Conidiophores generally borne from subsurface hyphae, stipes 150-250 x 3.0-4.0 µm, with stout, conspicuously roughened walls; penicilli a cluster of 2-3 terminal metulae, with sometimes a subterminal metula or cluster of metulae as well; metulae 12-25 x 3.0-4.0 µm, rough walled, often slightly enlarged apically; phialides ampulliform, in verticils of 6-12, measuring 9-15 x 2.0-2.5 µm, with undistinguished collula; conidia ellipsoidal, 3.0-3.5 x 2.0-3.0 µm, smooth walled, borne in disordered chains.

Typification. The dried herbarium specimen FRR 2660 is designated as holotype of Penicillium chalybeum. It was isolated from Indonesian dried fish, Decapterus sp., in Sydney, N.S.W., Australia, 1983, J. I. Pitt. A culture of the type isolate has been accessioned by CMI as IMI 288722 and by ATCC as ATCC 56975.

Distinguishing characteristics. This species is distinguished by rapidly growing, low, strictly velutinous colonies with an unusual smoky blue grey conidial colour, rough walled stipes and metulae in verticils of 2-3, sometimes with subterminal metulae as well, and often by unusual dull green marginal reverse colours on CYA.

Taxonomy. In the classification of Pitt (1979), Penicillium chalybeum is a member of subgen. Furcatum. In the key to that subgenus (Pitt, 1979: 237), it belongs in ser. Oxalica and will key to couplet 23 with P. rolfsii Thom and P. oxalicum Currie and Thom. Rough walled stipes distinguish P. chalybeum from the latter two species, and also suggest a possible affinity with P. raistrickii G. Smith and P. novae-zeelandiae van Beyma.

Isolates examined. Three isolates have been examined, from different samples of Indonesian dried fish: FRR 2660, type isolate, details above; FRR 2658 (= IMI 288721, ATCC 56974), from Trichogaster sp., and FRR 2659, from Decapterus sp., Sydney, N.S.W., Australia, 1983, J. I. Pitt.

Penicillium patens Pitt & Hocking, sp. nov.

Fig. 4

In agar CYA coloniae veteres unius hebdomadis 50-60 mm diam humiles et sparsae vel moderate densae velutinae radiatim sulcatae vel irregulariter caperatae; mycelium album involventia sclerotia; conidiogenesis sparsa vel moderata glauca; reverso castaneo vel brunneo. Sclerotia incolorata vel bruneola molles 130-200 x 130-150 µm; teleomorphus absens. Conidiophora portata ex hyphis submersis vel paginis stipites 500-800 x 2.5-3.0 µm parietibus tenuis et rugulosis monovorticillatae nonvesiculatae; phialides ampulliformae 8-10 x 2.5-3.0 µm collulis decrescentibus; conidia ellipsoidea 3.0-3.5 x 2.0-2.5 µm parietibus tenuis portatis inordinate catenis.

Typus: Herb. FRR 2661, ex pisce sicca Java, Sydney, Novo Wallio, Australi, 1984, J. I. Pitt.

Etym.: Latin patens = spreading, here referring to the colony habit of this species.

On CYA, 25°, 7 days, colonies 50-60 mm diam, low and sparse to moderately dense, strictly velutinous, finely radially sulcate or irregularly wrinkled; margins low; mycelium white, enveloping tardily developing sclerotia; conidiogenesis sparse to moderate, Greyish Green (27D3); exudate and soluble pigment absent; reverse orange to brown, in age sometimes becoming dark brown near Teak (6-7F5).

On MEA, 25°, 7 days, colonies 50-60 mm diam, low, sparse and velutinous, plane; margins subsurface; mycelium white, enveloping a layer of numerous, tardily developing sclerotia; conidiogenesis light to moderate, Dull Green near Nile Green (27-28D3); exudate and soluble pigment absent; reverse pale to dark brown near Teak (6F5).

On G25N, 25°, 7 days, colonies 15-18 mm diam, low to moderately deep,

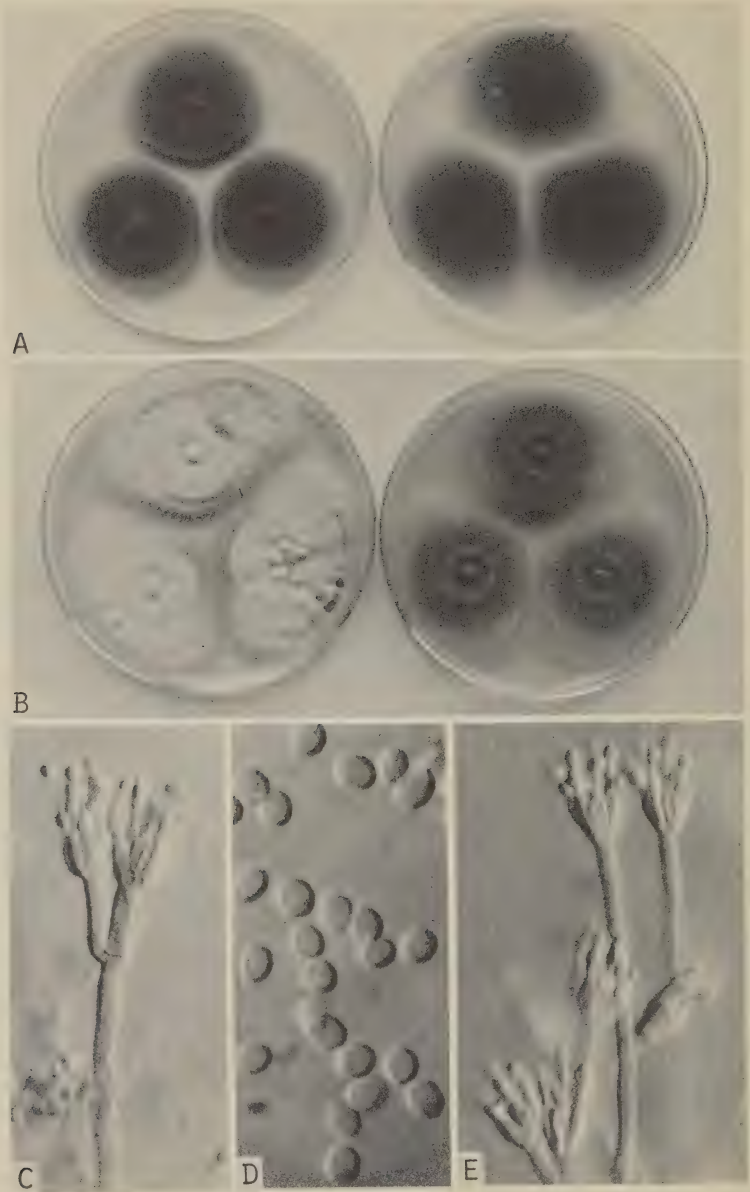


Fig. 4. *Penicillium chalybeum* and *P. patens*. A, C, D, *P. chalybeum*; A, colonies on CYA and MEA, 7 days, 25°; C, penicillus, X750; D, conidia, X1875. B, E, *P. patens*; B, colonies on CYA and MEA, 7 days, 25°; E, penicilli, X750.

dense, surface texture velutinous; conidiogenesis moderate to heavy, Greenish Grey (27-28D-E2); reverse pale.

At 5°, CYA, 7 days, at least germination, usually microcolonies formed.

At 37°, CYA, 7 days, no growth.

Sclerotia colourless to pale brown, soft, when mature 130-200 x 130-150 µm; teleomorph not known to be produced. Conidiophores borne from subsurface or surface mycelium, stipes long, 500-800 x 2.5-3.0 µm, with walls thin and finely to conspicuously roughened, strictly monoverticillate, nonvesiculate; phialides in verticils of 4-8, ampulliform, 8-10 x 2.5-3.0 µm, with short tapered collula; conidia ellipsoidal, 3.0-3.5 x 2.0-2.5 µm, smooth walled, borne in disordered chains.

Typification. The dried herbarium specimen FRR 2661 is designated as holotype of Penicillium patens, from Indonesian dried fish, Rastrelliger kanagurta, Sydney, N.S.W., Australia, 1984, J. I. Pitt. A culture of the type isolate has been accessioned by CMI as IMI 288723 and ATCC as ATCC 56980.

Distinguishing characteristics. This species is distinguished by velutinous, rapidly growing colonies with dark brown reverse colours, by nonvesiculate, strictly monoverticillate conidiophores and long, rough walled stipes.

Taxonomy. Penicillium patens is classified in sect. Exilicaulis of subgen. Aspergilloides in the classification of Pitt (1979). It will key within that subgenus to couplet 41 (Pitt, 1979: 168) along with P. donkii Stolk. The new species resembles P. donkii in some respects, including the production of pale brown, soft sclerotia and brown reverse colours. P. patens is distinguished from P. donkii by more rapid growth on all media at 25°, absence of growth at 37°, much deeper brown reverse colours, and long, rough walled stipes. Ecologically, the two species are quite distinct: P. donkii has been recorded only from soil in Alaska (Pitt, 1979: 191) and northern Canada (R. Summerbell, pers. comm.).

Isolate examined. This species is known only from the type isolate, FRR 2661, as detailed above.

Acknowledgements

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GENERA OF THE ERYSIPHACEAE

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摘 要

根据对我国白粉菌的研究,以及对其他国家的有关属的模式及非模式标本的研究,在 Erysiphaceae 科中共承认无性型 4 了属和有性型或全型 19 个属。它们分别是: Oidiopsis SCALIA, Oidium LINK, Ovulariopsis PAT. & HARIOT, Streptopodium ZHENG & CHEN; Arthrocladiella VASSILK., Blumeria GOLOV. ex SPEER, Brasiliomyces VIÉGAS, Bulbouncinula ZHENG & CHEN, Cystotheca BERK. & CURT., Erysiphe DC.:FR., Furcouncinula Z. X. CHEN & GAO, Leveillula ARN., Medusosphaera GOLOV. & GAMAL., Microsphaera LÉV., Phyllactinia LÉV., Pleo-chaeta SACC. & SPEG., Podosphaera KUNZE, Queirozia VIÉGAS & CARDOSO, Sawadaia MIYABE, Sphaerotheca LÉV., Typhulochaeta ITO & HARA, Uncinula LÉV. 和 Uncinuli-ella ZHENG & CHEN。可疑属为: Xenomysa SYD.。排除的属包括: Astomella THIRUM., Chilemyces SPEG., Leucococ-niella BAT. et al., Leucoconis THEISS. & SYD., Pa-rodellinopsis HANSF., Rhizotexis THEISS. & SYD., Schistodes THEISS. 和 Torora SYD.

科的形态及属的历史有简短的介绍。对承认的属提供有异名名单及线条图, 並有分属的纲要检索表及特征检索表。

SUMMARY

Based on studies of the powdery mildews in China, together with studies carried out on the type and nontype specimens of the related genera from other countries, 4 anamorphic, and 19 teleomorphic or holomorphic genera of the Erysiphaceae are considered acceptable. These include: Oidiopsis SCALIA, Oidium LINK, Ovulariopsis PAT. & HARIOT, Streptopodium ZHENG & CHEN; Arthrocladiella VASSILK., Blumeria GOLOV. ex SPEER, Brasiliomyces VIEGAS, Bulbouncinula ZHENG & CHEN, Cystotheca BERK. & CURT., Erysiphe DC. :FR., Furcuncinula Z. X. CHEN & GAO, Leveillula ARN., Medusosphaera GOLOV. & GAMAL., Microsphaera LEV., Phyllactinia LEV., Pleochaeta SACC. & SPEG., Podosphaera KUNZE, Queirozia VIEGAS & CARDOSO, Sawadaia MIYABE, Sphaerotheca LÉV., Typhulochaeta ITO & HARA, Uncinula LÉV., and Uncinuliella ZHENG & CHEN. Xenomys SYD. is treated as very doubtful; whereas the following genera are excluded from the Erysiphaceae: Astomella THIRUM., Chilemyces SPEG., Leucocconiella BAT. et al., Leucoconis THEISS. & SYD., Parodiellinopsis HANSF., Rhizotexis THEISS. & SYD., Schistodes THEISS. and Torca SYD.

Morphology of the family and historical notes of the genera are briefly introduced. Synonyms and line drawings are provided for the recognized genera. A synoptic key as well as a diagnostic key is also given.

INTRODUCTION

In the classification of the genera of the powdery mildews, most frequently importance was attached only to a few characteristics of the teleomorphs, observations generally being confined to the number of asci per ascocarp and the morphology of the appendages, etc., whereas little attention has been paid to other aspects of the teleomorphs, and especially to those of the anamorphs. This is why powdery mildews, so rich in kind and diverse in form and behaviour as they are, have seldom been sorted out properly, with the result that many genera are not recognized as they should have been.

Only 6-7 genera have been universally accepted as teleomorphic members of the family Erysiphaceae. For example, in THE FUNGI IVA, YARWOOD (1973) merely listed 7 genera: Erysiphe, Podosphaera, Sphaerotheca, Microsphaera, Uncinula, Phyllactinia and Leveillula. Nearly all of them were reported as early as the 19th Century. Although many new genera of the powdery mildews were described in the 20th Century, none was included in the family by him except Leveillula.

A few exceptions of authors recognizing more genera in

the Erysiphaceae can still be found. In the 7th edition of THE DICTIONARY OF THE FUNGI (HAWKSWORTH et al., 1983), as many as 28 genera were listed as members of the powdery mildews. BRAUN (1981) discerned 19 genera. Despite the fact that some of the genera in BRAUN's classification have to be reconsidered, his system is doubtless the most important one up to the present.

All the genera that have been listed or reported as powdery mildews will be further discussed in this paper.

MORPHOLOGY

THE ANAMORPHS:

Morphology of the anamorphic state of the powdery mildews has been most thoroughly studied by BOESEWINKEL (1980).

The MYCELIA of the powdery mildews are frequently found on the leaves of their host plants, but can also be formed on young shoots, tender tips, twigs, flowering parts and fruits. Mycelia of most genera are ectophytic, while Leveillula, Phyllactinia, Pleochaeta, Queirozia, and one species of Cystotheca (Cystotheca tñibodensis (GAUM.) KATUM.) have been reported to be subendophytic, that is, partly ectophytic and partly endophytic. Mycelia on the leaf blade may be epiphyllous, hypophyllous or amphigenous. Some species form roundish or irregularly outlined, thick or thin patches; others become effuse and do not form patches at all. The margin of patches may be distinct or indistinct. When severely attacked, the whole leaf surface may be covered with collapsed patches. Mycelia may be persistent throughout the season or evanescent.

The HYPHAE are straight, curved, flexuous or geniculate. Generally they branch profusely, while in a few species they do not branch at all. The width of the hyphae is quite different in different species. The hyphae are multiseptate, composed of cells which are usually thin-walled and uninucleate. Nuclei of the hyphae are relatively large and the nucleoli are distinct.

Mycelia of most species remain white throughout their growth, but many species of Sphaerotheca and some species of other genera may turn brown later. Hyaline to brown coloured, falcate SETAE (or termed 'special aerial hyphae' by some authors) can be formed by Blumeria and Cystotheca and hyaline, dichotomously branched ones can be formed by Queirozia on the mycelia. (Fig. 1, a-d)

By the help of APPRESSORIA, the mycelia can anchor themselves to the leaf surface of the host. According to BOESEWINKEL (1980), appressoria are formed by about 20-50% of the hyphal cells. Appressoria may be multilobed, moderately lobed to unlobed, and may be alternate, opposite or in sequence on the hyphae.

HAUSTORIA are organs which absorb nutrients from the

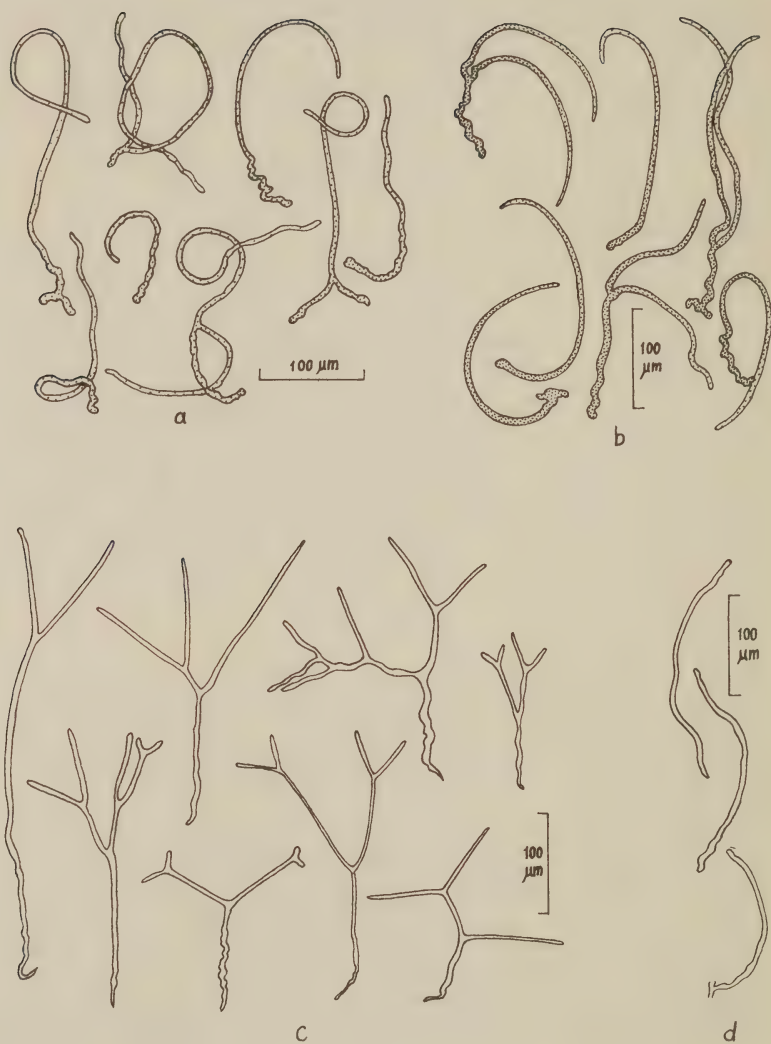


Fig. 1. Mycelial setae of some powdery mildews: a. Cystotheca tjibodensis, b. Cystotheca lanestris, c. Queirozia turbinata, d. Blumeria graminis.

hosts. In the epiphytic species, invading filaments are sent from the appressoria and penetrate through the host to form haustoria inside the epidermal cells. In subendophytic species, haustoria are formed inside the mesophyll cells of the host from the endomycelia. Most haustoria are spherical to pyriform in shape, a few can be slightly lobed and only those of Blumeria graminis (DC.) SPEER are deeply lobed and hence very characteristic. (Fig. 2, a-d)

During the growing season, the powdery mildews form conidiophores and conidia in large quantities.

CONIDIOPHORES of almost all genera of the ectophytic and subendophytic types are developed from the ectophytic mycelia and are seldom branched. The only exception is the Oidiopsis state of Leveillula, which develops its conidiophores from the endophytic mycelia, springing out through the stomata of the host and frequently branching. Most

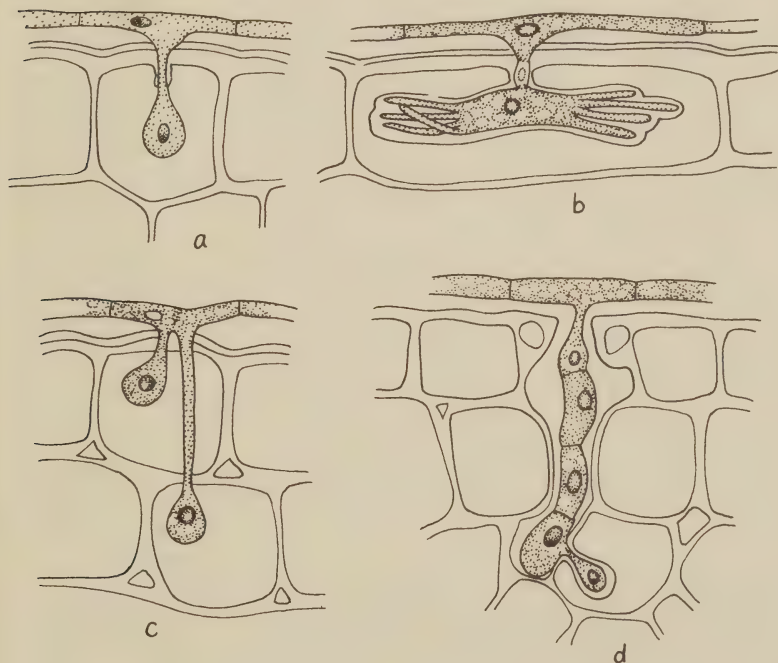


Fig. 2. Haustoria of some powdery mildews: a. Erysiphe polygoni, b. Blumeria graminis, c. Uncinula adunca, d. 'Phyllactinia corylea'. (SMITH, 1900)

conidiophores consist of 1-3 cells, rarely as many as 8 cells (BOESEWINKEL, 1980). The uppermost cell of the conidiophore is the sporogenous cell. Conidiophores are usually equal in diameter throughout, hyaline, and thin-walled with the exception of the Ovulariopsis state of Phyllactinia rigida (SALM.) BLUM. which is very thick-walled. Length of the conidiophores is greatly affected by environmental conditions, etc. Foot cells of the conidiophores are straight in most species, but some may be enlarging upward, or attenuating upward, or constricted abruptly. For example, according to BOESEWINKEL (1980), species with enlarging foot cells include the Oidium states of Erysiphe verbasci (JACZ.) BLUM., and Sphaerotheca aphanis (WALLR.) BRAUN (= Sphaerotheca alchemillae (GREV.) JUNELL); species with attenuating foot cells include the Oidium states of Erysiphe cruciferarum (OPIZ) JUNELL, Erysiphe pisi DC., Microsphaera viburni (DUBY) BLUM., and the Streptopodium state of Pleochaeta polychaeta (BERK. & CURT.) KIMBR. & KORF; while the Oidium state of Uncinula pyrenaica VIENN.-BOURG. may become strongly constricted at the base of the foot cells. Morphology of the foot cells of some species can be very characteristic. These can be curved in the Oidium states of Erysiphe sordida JUNELL, Uncinula clandestina (BIV.-BERN.) SCHROET., Uncinula miyabei (SALM.) SACC. & SYD., Uncinula ehretiae KEISSL.; subflexuous in the Oidium states of Erysiphe carpophila NEVOD, Microsphaera euonymi-japonica (ARC.) HERTER ex VIENN.-BOURG.; twisted several times in the Streptopodium states of all known species of Pleochaeta as well as in Phyllactinia dalbergiae PIROZ. and Phyllactinia yarwoodii PATW.; and bulbous in the Oidium state of Blumeria graminis (DC.) SPEER.

CONIDIA are formed on the conidiophores. Most genera and species have their conidia in chains, especially in the ectophytic types, but they may be solitary in the Oidium states of a few species of the genera Erysiphe, Microsphaera, and Uncinula. The Oidiopsis, Ovulariopsis or Streptopodium states of all species of the subendophytic genera such as Leveillula, Phyllactinia, Pleochaeta, Queirozia have their conidia borne singly on the conidiophores. There are various forms of conidia: ellipsoid, cylindrical, doliform, doliform-cylindrical, oblong, oval, claviform, obclaviform, lanceolate, or other irregular forms. Sizes of the conidia which are in chains are always smaller than those borne solitary. All conidia are unicellular and hyaline. Fibrosin bodies are often found in the conidia of the Oidium states of Cystotheca, Podosphaera, Sawadaia, Sphaerotheca, and Uncinula, as well as the Ovulariopsis state of Phyllactinia. Other genera do not have fibrosin bodies or rarely so, with very indistinct fibrosin bodies. Fibrosin bodies are clavate, conical, patellate, etc. and are easier to see in fresh material, hardly visible in old material. Germ tubes of the germinating conidia possess very characteristic morphology. NEGER (1902), HIRATA (1942, 1955, 1956), ZARACOVITIS (1964, 1965) and BOESEWINKEL (1977, 1980) have reported the morphology of the germinating conidia. They believed that by the use of diagnostic criteria

regarding the length of the germ tubes, position on the conidia where they germinate, shape of the germ tubes, as well as the shape of the appressoria on the germ tubes, together with the other characteristics of the anamorphs, one would be able to divide powdery mildews into genera and species. (Fig. 3, a-n)



Fig. 3. Characteristics of the anamorphs of the Erysiphaceae: a-j. *Oidium*, k-l. *Ovulariopsis*, m. *Streptopodium*, n. *Oidiopsis*. (teleomorphs: a. *Arthrocladiella mougeotii*, b. *Blumeria graminis*, c. *Erysiphe galeopsidis*, d. *Erysiphe aquilegiae* var. *ranunculi*, e. *Microsphaera euonymi-japonici*, f. *Uncinula necator*, g. *Uncinula pyrenaica*, h. *Podosphaera leucotricha*, i. *Sawadaia bicornis*, j. *Sphaerotheca fugax*, k. *Phyllactinia roboris*, l. *Phyllactinia rigida*, m. *Pleochaeta polychaeta*, n. *Leveillula taurica*.) (BOESEWINKEL, 1980)

THE TELEOMORPHS:

Sexual reproduction of the powdery mildews proceeds in late growing season. Finally asci and ascospores are developed in the ascocarps.

ASCOCARPS are formed on the surface of the hosts, most on the mycelial mat while the others are imbedded in it and interwoven with the mycelia. The ascocarp wall is generally composed of outer and inner walls each with several layers of cells. The outer and inner walls are undetachable in most genera, while those of Cystotheca can be completely detached. There is only one layer of cells when the powdery mildews first form their ascocarps. More layers are formed as the ascocarps become more and more mature, while the cell wall of the outer wall cells also becomes thicker and darker. Therefore, immature ascocarps usually show a yellow to yellowish-brown colour, while the mature ones are dark brown to blackish brown coloured. The only exception is the genus Brasiliomyces which has a very thin ascocarpic wall composed of one layer of cells retaining a pale brownish colour even at maturity. In genera like Blumeria, Erysiphe, Leveillula and Sphaerotheca, wall cells are similar at the upper and lower portion of the ascocarps. In other genera like Microsphaera, Pleochaeta, Sawadaia and Uncinula, wall cells at the upper part of ascocarps are more flattened in shape and thicker walled, cells at the lower part are larger and thinner walled, hence the ascocarps are said to be 'dorsiventral'. The outermost layer of wall cells of the ascocarps are often irregularly polygonal in shape, larger in diameter in some species or smaller in others. The wall cells of a few species of Sawadaia, Typhulochaeta and Uncinula may be radiately arranged. Depressed globose to globose is the usual shape of the ascocarps in most genera, but species of Pleochaeta and Queirozia have ascocarps of a turbinate form. All ascocarps are non-ostiolate and burst open to release their spores when mature. (Figs. 4, a-b; 5, a-f; 6, a-d)

Some of the cells of the superficial layer of the ascocarp can develop into APPENDAGES. In many genera, the appendages arise from the equatorial part of the ascocarps. Some may arise from the upper or basal portion of the ascocarps. Most genera have one type, the longer type of appendages. A few genera, like Bulbouncinula, Medusosphaera, Phyllactinia and Uncinuliella, have both longer and shorter types of appendages simultaneously on the same ascocarp. As a rule, the shorter type of appendages of the four above-mentioned genera are borne apically on the ascocarp and become gelatinized on contact with water after they are fully mature. The longer type of appendages in a few genera like Pleochaeta and Typhulochaeta may likewise deliquesce at least at their apices. This gelatinization is believed to play a very significant role in how the ascocarps adhere after being wind-blown from their original sites of production. Typical appendages, i.e. the longer type of appendages, with the exception of those in Blumeria and



Fig. 4. Ascocarps of the Erysiphaceae I: a. Phyllactinia ac-tinidia-latifoliae — ascocarp depressed globose, with asci arranged in a fascicle; b. Queirozia turbinata — ascocarp turbinate, with asci arranged in a hymenium.

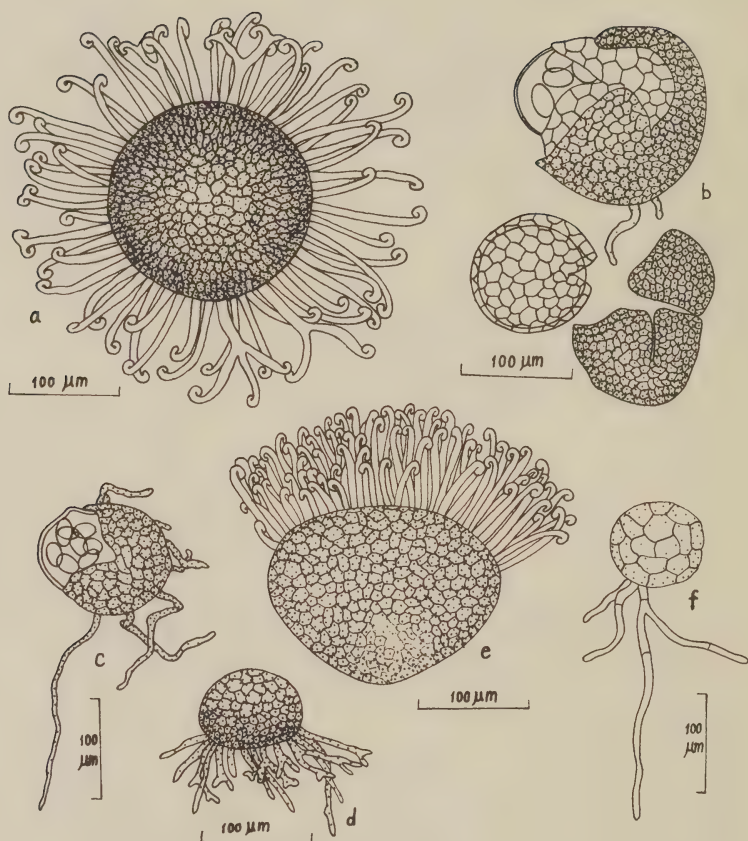


Fig. 5. Ascocarps of the Erysiphaceae II: a. Sawadaia bomien-sis — wall cells radiately arranged; b. Cystotheca tjobodensis — outer and inner walls of the ascocarp detachable, ascus single; c. Sphaerotheca aphanis — outer and inner walls of the ascocarp undetachable, ascus single; d. Erysiphe heraclei — with appendages arising from the basal part of the ascocarp; e. Pleochaeta salicicola — with appendages arising from the upper portion of the ascocarp; f. Sphaerotheca melampyri — with very large wall cells.

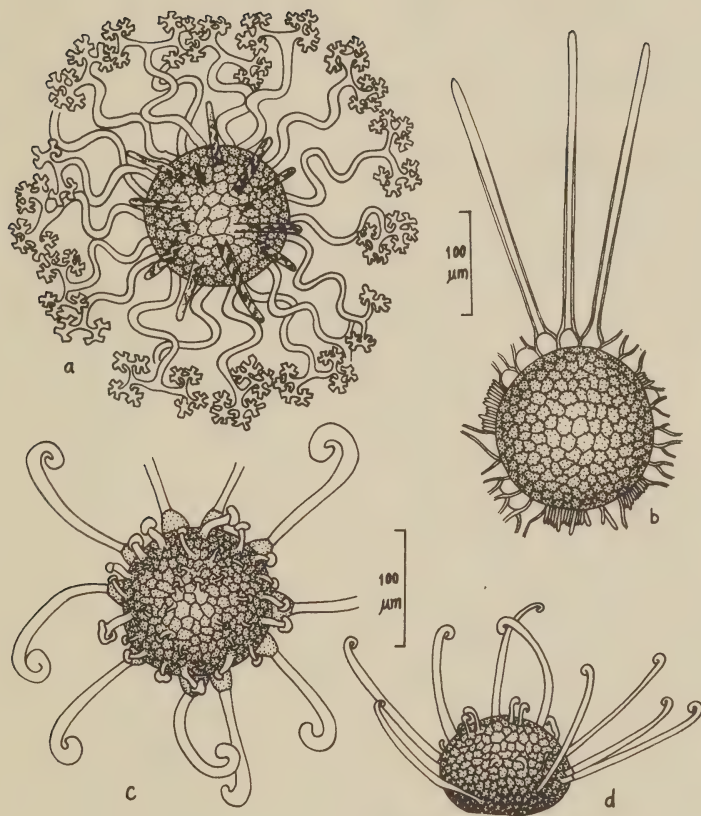


Fig. 6. Ascocarps of the Erysiphaceae III: a. Medusosphaera rosae, b. Phyllactinia corylopsidis, c. Bulbouncinula bulbosa, d. Uncinuliella simulans var. rosae-rubi. All genera have two types of appendages on the same ascocarp.

Brasiliomyces, which are more or less rudimentary, and those in Cystotheca, Erysiphe, Leveillula and Sphaerotheca, which are mycelioid, are well developed and non-mycelioid. Mycelioid appendages may be simple or irregularly branched, most oftenly nonuniform in width throughout their length, intertwined with each other, and are hard to enumerate. Non-mycelioid appendages, except in the apical portion, have the main stems hardly branched or if branched, then in a regular manner (e.g. dichotomously branched in Arthrocladiella and Sawadaia); with rare exception, most are uniform in width throughout, but may be tapering or enlarging upward. Moreover, with the exception of extremely long ones, they do not intertwine with each other and are easy to enumerate. All non-mycelioid appendages have very characteristic apices: those dichotomously branched several times are from Medusosphaera, Microsphaera, Podosphaera; those simply uncinatae are from Bulbouncinula, Pleochaeta, Queirozia, Sawadaia, Uncinula and Uncinuliella; those that become uncinatae and then di- or tri-furcate are from Furcouncinula; those needle-shaped are from Phyllactinia; those obtusely rounded or clavate are from Arthrocladiella and Typhulochaeta. A few genera like Bulbouncinula and Phyllactinia are bulbous at the base of the appendages. Besides the number of the appendages, location on the ascocarps, gross morphology of the entire appendages — straight, curved, geniculate, twisted, undulate, or flexuous, etc., length, width, changes in width — enlarging or tapering upwards, enlarging or tapering on the same appendages, etc., smooth or verrucose, septation, with or without basal cells, wall thickness — thick or thin walled throughout, or thinner at the upper part and becoming thicker downwards, etc., coloration, are all important criteria for the classification of species and varieties. As to the shorter type of appendages, their presence or absence, and their morphological distinctions bear little meaning in the classification of species and varieties, but are important in dividing genera, e.g. those capitate are from Bulbouncinula, those rod-shaped are from Medusosphaera, those penicillioid are from Phyllactinia, those falcate are from Uncinuliella. (Figs. 7, a-i; 8, a-j)

ASCI are formed in the ascocarps. In Cystotheca, Podosphaera and Sphaerotheca, one single ascus is formed in each ascocarp. In other genera, more than one ascus are formed. Excepting Pleochaeta and Queirozia which have their asci arranged in a hymenium, all the remaining genera with more than one ascus have their asci in a fascicle. Asci that are few in number usually take globose, subglobose, broadly ovate, ovate, irregularly ovate, etc., shapes, while those that are multiascal take elliptic-ovate, elliptic-clavate, oblong-ovate, etc., shapes. No matter what shape they take, the asci may be sessile, short-stipitate to evidently stipitate. Asci within an ascocarp are usually similar in size, but in rare cases like Erysiphe begoniae ZHENG & CHEN, there are two types — the macro- and micro-types of asci in an ascocarp. Asci usually are thin walled, rarely thick-walled. In most cases, the ascus

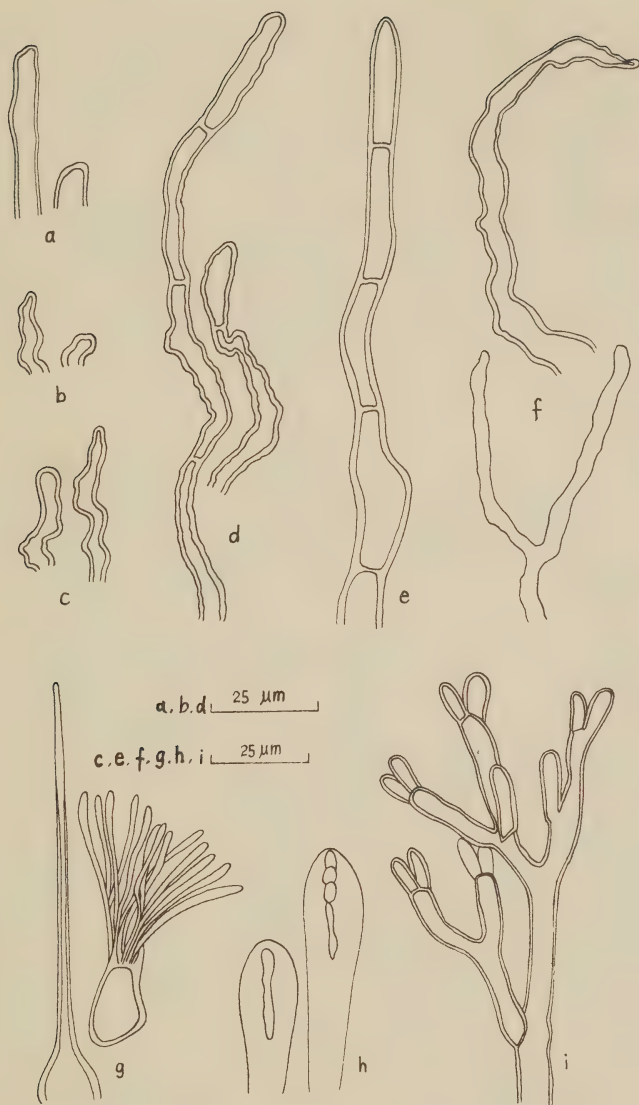


Fig. 7. Appendages of the Erysiphaceae I: a. Blumeria graminis, b. Brasiliomyces malachrae, c. Cystotheca wrightii, d. Erysiphe sambuci, e. Sphaerotheca astragali var. phaseoli, f. Leveillula leguminosarum, g. Phyllactinia actinidiae-latifoliae, h. Typhulochaeta alangii, i. Arthrocladiella mougeotii.

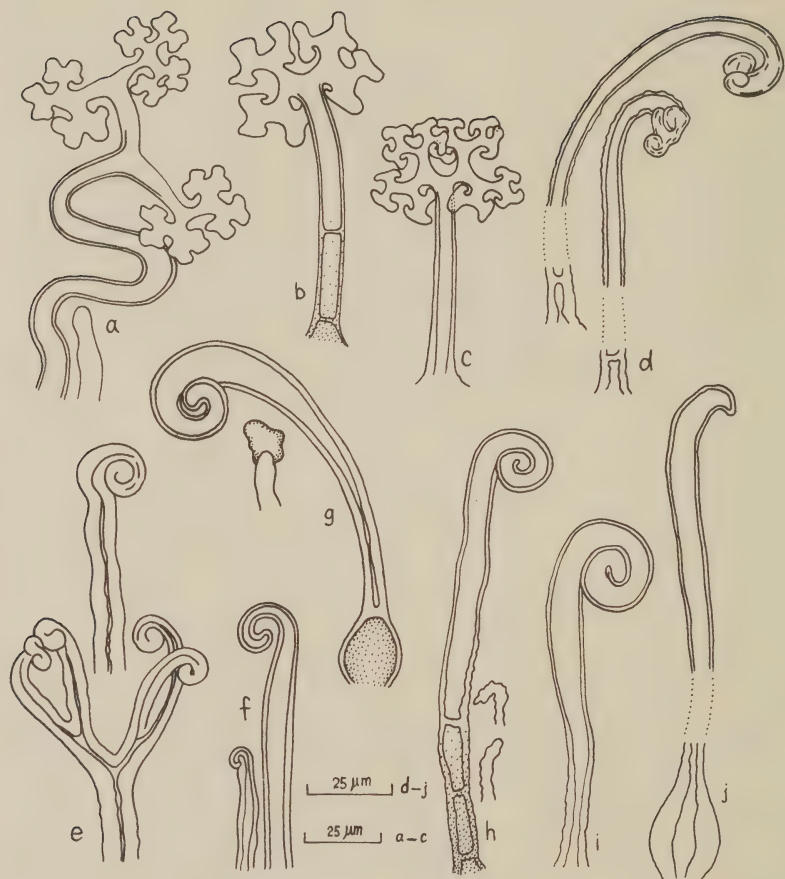


Fig. 8. Appendages of the Erysiphaceae II: a. Medusosphaera rosae, b. Podosphaera erineophila, c. Microsphaera sinensis, d. Furcuncinula wuyiensis, e. Sawadaia aesculi, f. Pleochaeta shiraiana, g. Bulbuncinula bulbosa, h. Uncinuliella australiana, i. Uncinula delavayi, j. Queirozia turbinata.

wall is smooth but may be occasionally verruculose. Mature asci burst open at the apical portion to release their spores. ERIKSSON (1981) has referred the Erysiphaceae to the bitunicate ascomycetes. According to his studies on Erysiphe cichoracearum DC., the asci were described as "Ectotunica thin; endotunica absent in uppermost part of ascus (i.e. a very wide oculus), thin below, without zonation and ring structures."

ASCOSPORES formed in an ascus are 2-8 in number, one-celled, hyaline or at most yellowish in colour, oval, elliptic, oblong, etc. Most commonly ascospores mature in autumn of the same year when they form their conidia, but in a small number of species, ascospores do not mature in the same year and only become mature in the next spring after overwintering. (Fig. 9, a-f)

HISTORICAL NOTES

Powdery mildews were described by early authors as Mucor Erysiphe (LINNAEUS, 1753) or Sclerotium Erysiphe (PERSOON, 1796). The first genus conforming to the demands of modern nomenclature was Erysiphe DC., which was published as Erysiphe HEDW. f. by de CANDOLLE in 1805. Species included in this genus belonged to 6 genera at the least according to our present knowledge.

The earliest generic name relating to the anamorphs of the powdery mildews was Oidium, established by LINK in 1809. LINK assigned his new genus to 'Mucedinaceae' (Moniliaceae) and did not mention the relationship with the Erysiphaceae. The name Oidium has been widely used for the anamorphs of the powdery mildews, but was also applied to different kinds of imperfect fungi by different authors. Since Oidium was emended by SACCARDO in 1880, BISBY (1953) proposed to conserve the name Oidium SACC. (1880), while a few authors (SOMSTINE, 1913; von ARX, 1970, etc.) preferred to use Acrosporium NEES (1817) in place of Oidium LINK. In 1978, Oidium LINK (1824, type species: Oidium monilioides (NEES:FR.) LINK) was adopted by the XII International Botanical Congress as a conserved name versus Oidium LINK:FR. (1809, type species: Trichoderma aureum (PERS.:FR.) PERS.), Oidium FR. (1832, type species: 'Mucor leprosus LINN. '), and Acrosporium NEES (1817, type species: Acrosporium monilioides NEES:FR.) as proposed by WERESUB in 1973. Most anamorphs of the Erysiphaceae belong to Oidium LINK.

Based on the works of the previous authors, LÉVEILLÉ proposed an important system in 1851. He divided the family Erysiphaceae into two sections according to the number of asci per perithecium, and then the sections were subdivided into 5 genera according to the morphology of the appendages. Two genera, Podosphaera KUNZE and Sphaerotheca LÉV. belonged to the section with a single ascus, while three genera, Phyllactinia LÉV., Uncinula LÉV. and Calocladia LÉV. belonged to the section with more than one ascus.

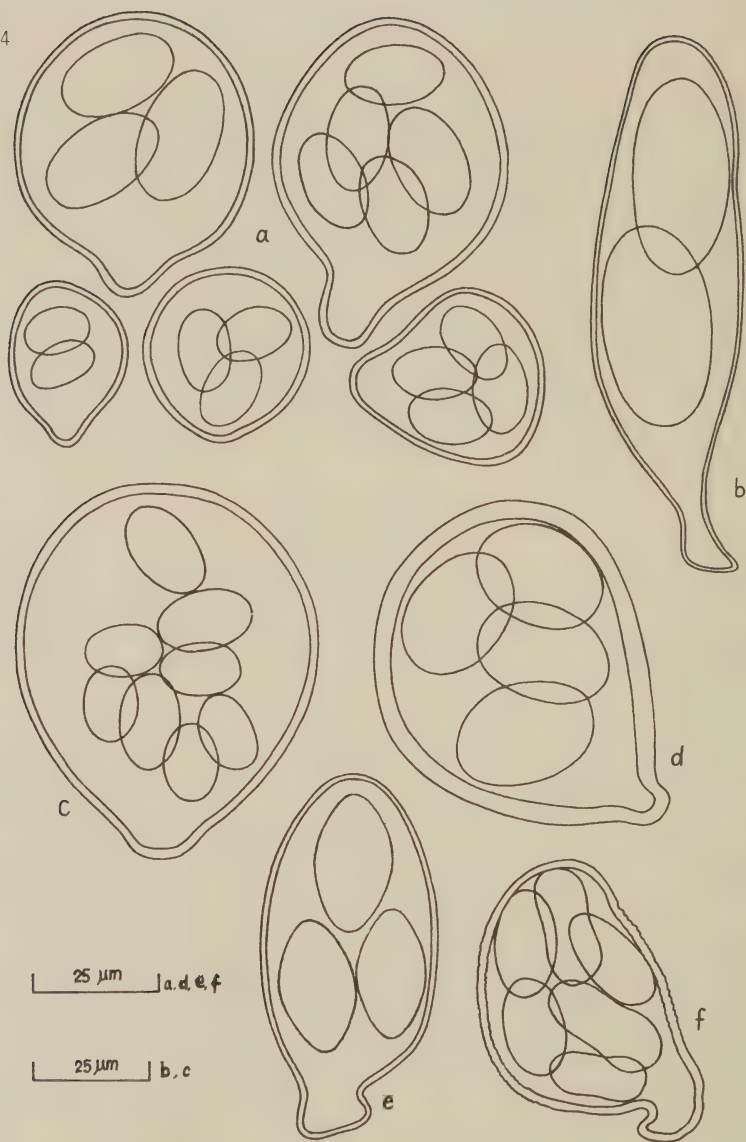


Fig. 9. Asci and ascospores of the Erysiphaceae: a. Erysiphe begoniae — both macro- and micro-types of asci and ascospores from a single ascocarp; b. Phyllactinia mandshuricae — asci thin-walled, ascospores 2 in number and very large; c. Sphaerotheca astragali — a single ascus from an ascocarp; d. Erysiphe sambuci var. crassitunicata — asci thick-walled; e. Erysiphe rorippae — asci thin-walled, ascospores somewhat pointed at both tips; f. Erysiphe epimedii — ascus wall verruculose.

The last genus (Calocladia) was immediately subdivided into Microsphaera LÉV. and Erysiphe HEDW. f. by himself in the same book. Except that Erysiphe was established in 1805 by de CANDOLLE as mentioned above, and Podosphaera in 1823 by KUNZE, all were LÉVEILLÉ's new genera.

In 1859, BERKELEY & CURTIS erected a new genus called Cystotheca. Owing to the dark mycelial setae of the type species Cystotheca wrightii BERK. & CURT., which rendered the mycelial patches dark coloured, BERKELEY & CURTIS classified their genus as a member of the 'Perisporiaceae'. Actually the characteristics of both anamorph and teleomorph of this genus are entirely different from the sooty molds, but in accord with the other known genera of the Erysiphaceae. Like Sphaerotheca, this genus has mycelioid appendages and one ascus in an ascocarp, and was thus considered to be synonymous with Sphaerotheca by a few authors (SAWADA, 1915; TAI, 1979). It differs from that genus by the presence of dark mycelial setae and two detachable layers of the ascocarpic wall, and many authors have preferred to retain it as an independent genus (HOMMA, 1937; BLUMER, 1967; ZHAO, 1979; BOESEWINKEL, 1980; BRAUN, 1981).

Erysiphella PECK was erected in 1875. The type species, Erysiphella aggregata PECK, was described as non-appendaged but was later reported to be appendaged (FARLOW, 1878; fide SALMON, 1900). It is doubtless congeneric with Erysiphe.

Pleochaeta SACC. & SPEG. was published in 1881 (SACCARDQ, 1881) but not widely accepted until it was restudied and republished by KIMBROUGH & KORF in 1963. Appendages of Pleochaeta are morphologically similar to those of Uncinula, but the anamorph is of the Streptopodium type and not of the Oidium type. It differs from Uncinula also in that the ascocarps are turbinate and not depressed-globose from their side view; the asci are arranged in a hymenial layer and not in a fascicle.

Erysiphopsis HALST. was established in 1899. Its type species, Erysiphopsis parnassiae HALST. was reduced to synonymy of Erysiphe polygoni DC. by SALMON (1900), thus making the genus synonymous with the genus Erysiphe. This genus has not been accepted by any author except SATHE (1969).

The second anamorphic genus of the powdery mildews, i.e. Ovulariopsis PAT. & HARLOT, was published in 1900. It differs from Oidium in possessing both endophytic and ectophytic and not merely ectophytic mycelia, principally solitary and not catenulate conidia. Most Phyllactinia species have Ovulariopsis type of anamorphs.

Trichocladia NEGER was established in 1901. Most of its early species were transferred from the genus Erysiphe. A part or the whole of the appendages are dichotomously branched one to several times at the apex, and the anamorph is of Oidium type, thus tallying with Microsphaera. The main difference between these two genera is that under natural conditions, the appendages of Trichocladia often turn

to one direction in fascicle. SALMON (1900), BLUMER (1933, 1967), HUMMA (1937), JUNELL (1967), TAI (1979), and BRAUN (1981) treated Trichocladia as a synonym of Microsphaera, while JACZEWSKI (1927), GOLOVIN (1950, 1960), VASJAGINA et al. (1961), SANDU-VILLE (1967), ZHAO (1979), and YU & LAI (1981) retained it as an independent genus.

Still another anamorphic genus, Oidiopsis SCALIA was published in 1902. Like Ovulariopsis the mycelia of Oidiopsis are subendophytic and the conidia are solitary; but the conidiophores are developed from the endophytic mycelia, emerging through the stomata of the host. Moreover, the conidiophores are apt to branch and hence dissimilar to Ovulariopsis. Anamorphs of Leveillula are exclusively Oidiopsis.

Sawadaia MIYABE is a small genus segregated from Uncinula (SAWADA, 1914). Both genera have appendages circinate at their tips, but a small to large portion of the appendages of Sawadaia may become di- to tri-chotomously divided several times beginning from the middle part upward. Furthermore, both genera have Oidium-type anamorphs, but in Sawadaia the macro- and micro-types of conidiophores and conidia may occur simultaneously or successively on the same host. This makes Sawadaia a unique genus in the family. Even so, the genus was not recognized by most European authors. In my opinion, not only should Sawadaia be segregated from Uncinula in its teleomorphic state but also from Oidium in its anamorphic state.

One year after Sawadaia was described, another new genus of powdery mildews was again reported from Japan. This was Typhulochaeta ITO & HARA (ITO, 1915), which was characterized by possessing simple and club-shaped appendages.

The genus Uncinulopsis SAW. erected in 1916 by SAWADA is a synonym of Pleochaeta.

In the system of THEISSEN & SYDOW (1917b), aside from the six traditionally recognized genera of Erysiphe, Microsphaera, Phyllactinia, Podosphaera, Sphaerotheca, and Uncinula, three more genera — Chilemyces SPEG. (1910), Leucoconis THEISS. & SYD. (1917) and Schistodes THEISS. (1917) were included in the Erysiphaceae. The same system was also adopted by WEHMEYER (1975). Among these three genera, Chilemyces has been shown to be synonymous with Dimerina THEISS. (1912), a member of the Dothideales (fide PETHAK & SYDOW, 1934); Schistodes has been shown to be synonymous with Perisporiopsis P. HENN. (1904), also member of the Dothideales (fide MÜLLER & von ARX, 1962). Though Leucoconis was accepted as one of the powdery mildew genera in all editions of AINSWORTH & BISBY's DICTIONARY OF THE FUNGI, no taxonomist working on the powdery mildews accepted it. Also the genus Rhizotexis THEISS. & SYD. (1917), which was included in the family Englerulaceae by its authors when it was first published (THEISSEN & SYDOW, 1917a), has been assigned to the Erysiphaceae as a doubtful genus in all editions of the DICTIONARY. In my opinion, since Leucoconis has multicelled ascospores and Rhizotexis has brown and 2-

celled ascospores, both must be excluded from the Erysiphaceae.

Leveillula ARN. was established in 1921, segregated as a new genus from Erysiphe. Appendages of Leveillula are also mycelioid, but the mycelia are partly ectophytic and partly endophytic, its anamorph is of Oidiopsis type. It is very different from Erysiphe.

Lanomyces GÄUMANN (1922) was reported to be a new genus of 'Perisporiales' when it was first described. After studying the type species (Lanomyces tjibodensis GAUM.) of the genus, KATUMOTO (1973) thought that it did not belong to sooty molds but to Erysiphaceae instead. He transferred Lanomyces tjibodensis to Cystotheca, thus making it a new combination — Cystotheca tjibodensis (GAUM.) KATUM. GÄUMANN (1922) described the asci of this fungus as multi-spored, while KATUMOTO (1973) reported it as 8-spored. The number of spores per ascus, according to our study on the type specimen of Cystotheca tjibodensis tallies with that of KATUMOTO. Aside from the partly ectophytic and partly endophytic mycelia, Cystotheca tjibodensis agrees well in other respects with all known species of Cystotheca.

Toroea SYD. was not included in the powdery mildews by its own author when he published it (TORO, 1926). It was treated as a member of the Erysiphales in the 6th edition of the DICTIONARY and Dothideales in the 7th edition as a result of the study by von ARX & MÜLLER (1975).

Uncinulella HARA is an illegitimate name since it was not described in Latin when published in 1936. Morphologically, it shows no difference from Uncinula.

Xenomyxa SYD. was considered to be a very isolated genus and was not referred to any family when it was first published by SYDOW in 1939 from Ecuador. It was, however, referred to the Erysiphales in the 6th edition of the DICTIONARY, but was referred to Dothideales in the 7th edition. According to my study of the type specimen of the type species, Xenomyxa disseminata SYD., the fungus is in accord with the powdery mildews in growing superficially, ascocarps non-ostiolate, with mycelioid appendages, asci arranged in a fascicle, ascospores hyaline and with no septation. But there are also several aspects which may distinguish it from the common members of Erysiphaceae: (1) it parasitizes a fern host; (2) ascocarps deliquesce after maturation; (3) asci of different degrees of maturation are always present in the same ascocarp, indicating a different type of ascus development; (4) asci are surrounded by a mucilaginous layer. It is doubtful whether it is a true powdery mildew; it is better to wait till its anamorph is found before recognizing it.

Orthochaeta SAW. is another illegitimate name which did not have a Latin diagnosis when it was published in 1943. The type species of the genus, Orthochaeta acalyphae SAW., is known to be synonymous with Uncinula acalyphae TAI (1946). The latter was transferred to Erysiphe by ZHENG & CHEN

(1981) and became a new combination Erysiphe acalyphae (TAI) ZHENG & CHEN. The genus Orthochaeta was likewise treated as a synonym of Erysiphe by these authors.

One year later, VIEGAS (1944) reported a new genus, Brasiliomyces VIEGAS, with a typical Oidium state from Brazil. The absence of appendages on the ascocarp was taken as a most important characteristic of the genus, but these were found to be present in all known species by ZHENG (1984). The genus is unique in the extremely thin ascocarpic wall composed of only one layer of cells.

In the same year, another genus of powdery mildews, Queirozia VIEGAS & CARDOSO (1944) was reported. It is closely related to Pleochaeta in having subendophytic mycelia, turbinate ascocarps, and asci arranged in a hymenial layer. BRAUN (1981) reduced it to synonymy with Pleochaeta. I have studied the type specimen of the type species, Queirozia turbinata VIEGAS & CARDOSO. In this fungus there are many colourless, non-septate, and dichotomously branched mycelial setae that are never found in Pleochaeta. More important is the morphology of the appendages: although they are hooked as in Pleochaeta, yet the apex of these is distinctly pointed and the basal part bulbous in shape, thus contrasting with Pleochaeta very sharply.

Parodiellinopsis HANSF. (1946) was assigned to Erysiphales with a question mark in the 6th edition of the DICTIONARY but was treated as a synonym of Chevalieropsis ARN. (1923), a member of the Dothideales, by von ARX & MÜLLER (1975).

In 1947, THIRUMALACHAR reported Astomella THIRUM. from India. Despite the fact that the ascospores are 2-celled and coloured, THIRUMALACHAR still referred it to the family Erysiphaceae. It is very unnatural to accommodate this fungus in the powdery mildews since all known species of the powdery mildews have single-celled and hyaline ascospores.

Arthrocladia GOLOV. (1956) is a nomen nudum as well as a homonym of the algal genus Arthrocladia DUBY (1830). It was republished as Arthrocladiella VASSILK. in 1960.

Two years later, the same author published another new genus Linkomyces GOLOV. (1958), which was again a nomen nudum. This genus was segregated from Erysiphe to accommodate those forms with Pseudoidium type of conidia (conidia solitary on the conidiophores).

Ischnochaeta SAW. (1959) was another genus based on the same grounds as Linkomyces. SAWADA did not publish a Latin diagnosis until 1959, though he established his new genus in 1951. Both Linkomyces and Ischnochaeta are treated as synonyms of Erysiphe by most authors.

Like Orthochaeta acalyphae SAW. (1943), the type species of Salmonomyces CHIDD. published in 1959 was another synonym of Uncinula acalyphae TAI (1946) (= Erysiphe acalyphae (TAI) ZHENG & CHEN). Hence, Salmonomyces was either reduced to synonym of Uncinula (PIROZYNSKI, 1965; BRAUN, 1981)

or Erysiphe (ZHENG & CHEN, 1981).

In 1960, BATISTA et al. reported a new genus, Leucoconiella BAT. et al. from Paraguay. The ascocarps were described as pseudo-ostiolate and with paraphyses, while the ascospores are multiseptate, and hence the genus must be excluded from the Erysiphaceae.

Arthrocladiella VASSILK. (1960) was a segregate from Microsphaera. The appendages of Arthrocladiella are multiseptate and dichotomously branched one to several times on the main stem. The shape of the conidia is also different from those of Microsphaera.

Medusosphaera GOLOV. & GAMAL. (1962) is one of the few genera possessing two types of appendages on the same ascocarp. The longer type appendages are strongly undulate at the main portion and dichotomously branched one to several times at the apex; the shorter type appendages are rod-shaped.

The only and type species of Salmonia BLUM. & MÜLLER (1964), Salmonia malachrae (SEAV.) BLUM. & MÜLLER, is known to be synonymous with Brasiliomyces malvastri VIÉGAS (1944), type species of the genus Brasiliomyces. Thus, Salmonia is also a synonym of Brasiliomyces.

Kokkalera PONN. (1970) is another tropical genus that can form ascocarps. It forms 'non-appendaged' ascocarps each with a single ascus in its teleomorphic state and forms Oidium type conidia with fibrosin bodies in its anamorphic state. This fungus has been reported only once. We have studied the type specimen of the type species, Kokkalera crotonis PONN., borrowed from Herb. IMI. Unfortunately, no ascocarp was found. PONNAPPA (1970) did realize that Kokkalera was closely related to Sphaerotheca, but he emphasized the importance of the absence of appendages on the ascocarp and published it as a new genus. As stated above, both Xenomyxa and Brasiliomyces were also said to be non-appendaged but true, though rudimentary, appendages were found after studying their type specimens. In fact, from the photo of Kokkalera crotonis published by PONNAPPA (1970), appendages growing out from the basal part of the ascocarp can be seen clearly. It seems to me that Kokkalera does not warrant an independent genus at all. Dr. Uwe BRAUN of GDR also holds the same view that Kokkalera is merely a synonym of Sphaerotheca (personal communication).

Blumeria GOLOV. ex SPEER was first described in Russian by GOLOVIN (1958) and then in Latin by SPEER (1974). The genus includes only one species, i.e. Blumeria graminis (DC.) SPEER (basionym Erysiphe graminis DC.). SPEER emphasized the existence of a sub-cortical intermediate zone between the atrosclerocortex and the hymenium of the ascocarp as a most salient feature for Blumeria. Aside from the difference in the anatomical characteristics of the ascocarps, many more differences in the anamorphic state of Blumeria and Erysiphe can also be found. Although both genera have an Oidium type anamorph, Blumeria has a bulbous

base of the conidiophores, falcate-shaped mycelial setae, and haustoria which are digitate and hence very different from Erysiphe. More important still, the host specificity of Blumeria is also unlike that of all genera of the family including Erysiphe, with the former parasitizing exclusively monocotyledons and not dicotyledons. Again, in my opinion, as in the case of Sawadaia, not only the teleomorphs but also the anamorphs of Blumeria and Erysiphe should be separated into different genera.

Streptopodium ZHENG & CHEN (1978) was created to accommodate those powdery mildews with basally twisted conidiophores in the anamorphic state as distinct from the typical Ovulariopsis. All species of Pleochaeta with known anamorphic state, two species of Phyllactinia and the only species of Queirozia have been reported to have Streptopodium state of anamorphs.

In 1979, ZHENG & CHEN segregated two new genera from the genus Uncinula on the same ground that two kinds, instead of one kind of appendages, were simultaneously present on the same ascocarp. In Uncinuliella ZHENG & CHEN the longer type appendages are also uncinulate at the apex but not bulbous at the base; while the shorter type appendages are falcate in shape (ZHENG & CHEN, 1979a). In Bulbouncinula ZHENG & CHEN, the longer type appendages are uncinulate at the apex and bulbous at the base; while the shorter type appendages are capitate in form. (ZHENG & CHEN, 1979b).

In 1981, BRAUN used Erysiphe trina HARKN. as a basionym for Californiomyces trina (HARKN.) BRAUN to erect a new genus Californiomyces BRAUN. He claimed that Californiomyces differed from Brasiliomyces in the presence of appendages and the size and number of ascospores. After studying all known species of the two genera, ZHENG (1984) reduced Californiomyces to synonymy with Brasiliomyces since both of them have rudimentary appendages and very thin ascocarpic wall composed of one layer of cells.

The latest genus reported in Erysiphaceae was Furcuncinula Z. X. CHEN (CHEN et al., 1982) from China. The genus is characterized by the morphology of the appendages which are uncinulate and then di- or tri-furcate at their apices.

RECOGNIZED GENERA

THE ANAMORPHS:

Oidiopsis SCALIA, Agricolt. Calabro-Siculo 27:396. 1902.

TYPE SPECIES: Oidiopsis sicula SCALIA

TELEOMORPH: Leveillula ARN.

Oidium LINK in WILLDENOW, Sp. Pl. 6(1):121. 1824. nom. cons.

HOMONYMS: Oidium LINK:FR., Mag. Ges. Naturf. Fr. Berl.

3:18. 1809. nom. rej.; Oidium FR., Syst. Mycol. 3:427. 1832. nom. rej.

SYNONYM: Acrosporium NEES, Das System der Pilze und Schwämme. p.53. 1817. nom. rej.

TYPE SPECIES: Oidium monilioides (NEES:FR.) LINK (Basionym: Acrosporium monilioides NEES:FR.)

TELEOMORPHS: Arthrocladiella VASSILK.; Blumeria GOLOV. ex SPEER; Brasiliomyces VIÉGAS; Cystotheca BERK. & CURT.; Erysiphe DC.; Medusosphaera GOLOV. & GAMAL.; Microsphaera LÉV.; Podosphaera KUNZE; Sawadaia MIYABE; Sphaerotheca LÉV.; Uncinula LÉV.; Uncinuliella ZHENG & CHEN

Ovulariopsis PAT. & HARIOT, J. Bot. 14:245. 1900.

TYPE SPECIES: Ovulariopsis erysiphoides PAT. & HARIOT

TELEOMORPH: Phyllactinia LÉV.

Streptopodium ZHENG & CHEN, Acta Microbiol. Sinica 18:183. 1978.

SYNONYM: Ovulariopsis PAT. & HARIOT, J. Bot. 14:245. 1900. p.p.

TYPE SPECIES: Streptopodium bonariensis (SPEG.) ZHENG & CHEN (Basionym: Ovulariopsis bonariensis (SPEG.) SPEG.)

TELEOMORPHS: Phyllactinia LÉV.; Pleochaeta SACC. & SPEG; Queirozia VIÉGAS & CARDOSO

THE TELEOMORPHS:

Arthrocladiella VASSILK., Bot. Zhurn. 45:1368. 1960.

SYNONYMS: Microsphaera LÉV., Ann. Sci. Nat. III. 15:381. 1851. p.p.; Arthrocladia GOLOV., Tr. Bot. Inst. Komarov, Akad. Nauk SSSR, II. 10:306. 1956. nom. nud.

TYPE SPECIES: Arthrocladiella mougeotii (LÉV.) VASSILK. (Basionym: Microsphaera mougeotii LÉV.)

ANAMORPH: Oidium LINK

Blumeria GOLOV. ex SPEER, Sydowia 27:2. 1974.

SYNONYMS: Erysiphe DC., Flore Fr. 2:272. 1805. p.p.; Blumeria GOLOV., Sborn. Rabot. Inst. Prikl. Zool. Fitop. 5:124. 1958. nom. nud.

TYPE SPECIES: Blumeria graminis (DC.) SPEER (Basionym: Erysiphe graminis DC.)

ANAMORPH: 'Oidium LINK'*

Brasiliomyces VIÉGAS, Bragantia 4:17. 1944. emend. ZHENG, Mycotaxon 19:284. 1984.

SYNONYMS: Erysiphe DC., Flore Fr. 2:272. 1805. p.p.; Salmonia BLUM. & MÜLL., Phytopath. Z. 50:382. 1964; Californiomyces BRAUN, Nova Hedwigia 34:688. 1981.

*Different from the typical Oidium in being bulbous at the base of the conidiophores.

TYPE SPECIES: Brasiliomyces malvastri VIÉGAS (= Brasiliomyces malachrae (SEAV.) BOESEW.)
ANAMORPH: Oidium LINK

Bulbouncinula ZHENG & CHEN, Acta Microbiol. Sinica 19:376. 1979.

SYNONYM: Uncinula LÉV., Ann. Sci. Nat. III. 15:151. 1851. p.p.

TYPE SPECIES: Bulbouncinula bulbosa (TAI & WEI) ZHENG & CHEN (Basionym: Uncinula clintonii PECK var. bulbosa TAI & WEI)

ANAMORPH: unknown

Cystotheca BERK. & CURT., Proc. Am. Acad. Arts Sci. 4:130. 1859.

SYNONYM: Lanomyces GÄUM., Ann. Jard. Bot. Buitenz. 32:43. 1922.

TYPE SPECIES: Cystotheca wrightii BERK. & CURT.

ANAMORPH: Oidium LINK

Erysiphe DC.:FR., Flore Fr. 2:272. 1805.

SYNONYMS: Erysiphella PECK, XXVIII Rep. N. Y. State Mus. 2:63. 1874; Erysiphopsis HALST., Bull. Torrey Bot. Club 26:594. 1899; Orthochaeta SAW., Descript. Catal. Taiwan Fungi VII:22. 1943. nom. nud.; Salmonomyces CHIDD., Sydowia 13:55. 1959; Ischnochaeta SAW., Descript. Catal. Taiwan Fungi IX:16. 1959. p.p. nom. illegit.; Linkomyces GOLOV., Sborn. Rabot. Inst. Prikl. Zool. Fitop. 5:127. 1958. nom. nud.

TYPE SPECIES: Erysiphe polygoni DC.

ANAMORPH: Oidium LINK

Furcuncinula Z. X. CHEN in CHEN et al., Acta Mycol. Sinica 1:19. 1982.

TYPE SPECIES: Furcuncinula wuyiensis Z. X. CHEN & GAO

ANAMORPH: unknown

Leveillula ARN., Ann. Epiph. 7:92. 1921.

SYNONYM: Erysiphe DC., Flore Fr. 2:272. 1805. p.p.

TYPE SPECIES: Leveillula taurica (LÉV.) ARN. (Basionym: Erysiphe taurica LÉV.)

ANAMORPH: Oidiopsis SCALIA

Medusosphaera GOLOV. & GAMAL., Bot. Mat. 15:91. 1962.

TYPE SPECIES: Medusosphaera rosae GOLOV. & GAMAL.

ANAMORPH: Oidium LINK

Microsphaera LÉV., Ann. Sci. Nat. III. 15:381. 1851.

SYNONYMS: Calocladia LÉV., Ann. Sci. Nat. III. 15:154.

1851; Trichocladia NEGER, Rev. Fl. Paris. p.350. 1901

TYPE SPECIES: Microsphaera divaricata (WALLR.) LÉV. (Basionym: Alphitomorpha divaricata WALLR.)

ANAMORPH: Oidium LINK

Phyllactinia LÉV., Ann. Sci. Nat. III. 15:144. 1851.

TYPE SPECIES: Phyllactinia guttata (WALLR.:FR.) LÉV.

(Basionym: Alphitomorpha guttata WALLR.:FR.)

ANAMORPHS: Ovulariopsis PAT. & HARTOT; Streptopodium ZHENG & CHEN

Pleochaeta SACC. & SPEG. in SACC., Michelia 2:373. 1881.
emend. KIMBR. & KORF, Mycologia 55:623. 1963.

SYNONYMS: Uncinula LÉV., Ann. Sci. Nat. III. 15:151.

1851. p.p.; Pleochaeta SACC. & SPEG. in SPEG., Anal.

Soc. Crent. Argent. 10:64. 1880. nom. nud.; Uncinu-

lopsi SAW., Trans. Formosa Nat. Hist. Soc. 6:33.
1916.

TYPE SPECIES: Pleochaeta lynchii (SPEG.) SPEG. (=Pleo-
chaeta polychaeta (BERK. & CURT.) KIMBR. & KORF)

ANAMORPH: Streptopodium ZHENG & CHEN

Pososphaera KUNZE in KUNZE & SCHMIDT, Myk. Heft. 2:111.
1823.

SYNONYM: Sphaeria FR., Syst. Mycol. II:319. 1823. p.p.

TYPE SPECIES: Podosphaera myrtillina (SCHUB.:FR.) KUNZE

(Basionym: Sphaeria myrtillina SCHUB.:FR.)

ANAMORPH: Oidium LINK

Queirozia VIÉGAS & CARDOSO, Bol. Soc. Brazil. Agron. 7:5.
1944.

TYPE SPECIES: Queirozia turbinata VIÉGAS & CARDOSO

ANAMORPH: Streptopodium ZHENG & CHEN

Sawadaia MIYABE in SAW., Agric. Exp. Stat. Formosa, Spec.
Bull. 9:49. 1914.

SYNONYM: Uncinula LÉV., Ann. Sci. Nat. III. 15:151. 1851.
p.p.

TYPE SPECIES: Sawadaia bicornis (WALLR.:FR.) HOMMA (Ba-

sionym: Alphitomorpha bicornis WALLR.:FR.)

ANAMORPH: 'Oidium LINK'*

Sphaerotheca LÉV., Ann. Sci. Nat. III. 15:138. 1851.

SYNONYM: Kokkalera PONN., Sydowia 23:4. 1970.

TYPE SPECIES: Sphaerotheca pannosa (WALLR.:FR.) LÉV.

(Basionym: Alphitomorpha pannosa WALLR.:FR.)

ANAMORPH: Oidium LINK

Typhulochaeta ITO & HARA in ITO, Bot. Mag. Tokyo 29:20.
1915.

SYNONYM: Erysiphe DC., Flore Fr. 2:272. 1805. p.p.

TYPE SPECIES: Typhulochaeta japonica ITO & HARA

ANAMORPH: unknown

*Different from the typical Oidium in possessing both macro- and micro-types of conidiophores and conidia.

Uncinula LÉV., Ann. Sci. Nat. III. 15:151. 1851.

SYNONYM: Uncinulella HARA, Plant Parasitic Fungi of Japan. p.133. 1936. nom. illegit.

TYPE SPECIES: Uncinula bivonae LÉV. (= Uncinula clandestina (BIV.-BERN.) SCHROET.)

ANAMORPH: Oidium LINK

Uncinuliella ZHENG & CHEN, Acta Microbiol. Sinica 19:283. 1977.

SYNONYM: Uncinula LÉV., Ann. Sci. Nat. III. 15:151. 1851. p.p.

TYPE SPECIES: Uncinuliella simulans (SALM.) ZHENG & CHEN (Basionym: Uncinula simulans SALM.)

ANAMORPH: Oidium LINK

DOUBTFUL GENUS

Xenomyxa SYD., Ann. Mycol. 37:336. 1939.

TYPE SPECIES: Xenomyxa disseminata SYD.

ANAMORPH: unknown

EXCLUDED GENERA*

Astomella THIRUM., New Phytologist 46:271. 1947.

Chilemyces SPEG., Fungi Chilensis. p.27. 1910.

Leucoconiella BAT. et al., Broteria N. S. 29:130. 1960.

Leucoconis THEISS. & SYD., Ann. Mycol. 15:456. 1917.

Parodiellinopsis HANSF., Proc. Linn. Soc. London 1944-46: 141. 1946.

Rhizotexis THEISS. & SYD., Ann. Mycol. 15:140. 1917.

Schistodes THEISS., Ann. Mycol. 15:456. 1917.

Toroea SYD. in TORO, J. Departm. Agric. Porto Rico 10(2):19. 1926.

*None of excluded genera listed have anamorphs assignable to the accepted genera. Ascospores of all these genera are 2-many-celled. Ascospores of Astomella, Parodiellinopsis, Rhizotexis, Schistodes and Toroea are even brownish to brown in colour. Leucoconiella and Toroea are considered to be particularly unacceptable because of their pseudo-ostiole and paraphysate ascocarps.

KEYS TO GENERA RECOGNIZED

SYNOPTIC KEY:

Abbreviation

ANAMORPHS

<u>Oidiopsis</u>	Os	<u>Ovulariopsis</u>	Ov
<u>Oidium</u>	Om	<u>Streptopodium</u>	St

TELEOMORPHS or HOLOMORPHS

<u>Arthrocladiella</u>	A	<u>Phyllactinia</u>	Ph
<u>Blumeria</u>	Bl	<u>Pleochaeta</u>	Pl
<u>Brasiliomyces</u>	Br	<u>Podosphaera</u>	Po
<u>Bulbouncinula</u>	Bu	<u>Queirozia</u>	Q
<u>Cystotheca</u>	C	<u>Sawadaia</u>	Sa
<u>Erysiphe</u>	E	<u>Sphaerotheca</u>	Sp
<u>Furcuncinula</u>	F	<u>Typhulochaeta</u>	T
<u>Leveillula</u>	L	<u>Uncinula</u>	U
<u>Medusosphaera</u>	Me	<u>Uncinuliella</u>	Un
<u>Microsphaera</u>	Mi		

I. Type of mycelia:

1. Subendophytic — Os, Ov, St; L, Ph, Pl, Q, C. tijbo-
densis
2. Ectophytic — Om; A, Bl, Br, Bu, C, E, F, Me, Mi, Po,
Sa, Sp, T, U, Un

II. Presence or absence of aerial setae:

1. With subhyaline to brown, falcate aerial setae — Om
(in some species); Bl, C
2. With hyaline, dichotomously branched aerial setae —
St (in one species only); Q
3. Without aerial setae — Os, Om (in most species), Ov,
St (in most species); A, Br, Bu, E, F, L, Me, Mi,
Ph, Pl, Po, Sa, Sp, T, U, Un

III. Types of conidiophores and conidia:

1. With macro-type of conidiophores and conidia only —
Os, Om (in most species), Ov, St; A, Bl, Br, C, E,
L, Me, Mi, Ph, Pl, Po, Q, Sp, U, Un
2. With macro- and micro-types of conidiophores and conidia — Om (in some species); Sa

IV. Morphology of the foot cells of the conidiophores:

1. Bulbous — Om (in one species only); Bl
2. Twisted several times — St; Ph (in some species), Pl,
Q
3. Mostly simple — Os, Om (in most species), Ov; A, Br,
C, E, L, Me, Mi, Ph (in most species), Po, Sa, Sp,
U, Un

V. Branching of the conidiophores:

1. Frequently branched — Os; L
2. Usually unbranched — Ov, Om, St; A, Bl, Br, C, E, Me, Mi, Ph, Pl, Po, Q, Sa, Sp, U, Un

VI. Catenulation of the conidia:

1. Single — Os, Om (in some species), Ov, St; E (in a few species), L, M (in a few species), Ph, Pl, Q, U (in a few species), Un (in one species)
2. In chains — Om (in most species); A, Bl, Br, C, E, (in most species), Me, Mi (in most species), Po, Sa, Sp, U (in most species), Un (in one species)

VII. Structure of the ascocarpic wall:

1. Composed of 1 layer of cells only, hence not differentiated into outer & inner walls — Br
2. Composed of several layers of cells and differentiated into detachable outer & inner walls — C
3. Composed of several layers of cells and differentiated into undetachable outer & inner walls — A, Bl, Bu, E, F, L, Me, Mi, Ph, Pl, Po, Q, Sa, Sp, T, U, Un

VIII. Number of asci in an ascocarp:

1. Single — C, Po, Sp
2. More than one — A, Bl, Br, Bu, E, F, L, Me, Mi, Ph, Pl, Q, Sa, T, U, Un

IX. Arrangement of asci in the ascocarp:

1. In hymenial layer — Pl, Q
2. In fascicle — A, Bl, Br, Bu, C, E, F, L, Me, Mi, Ph, Po, Sa, Sp, T, U, Un

X. Types of appendages present:

1. With 2 types (the longer & shorter types) of appendages on the same ascocarp — Bu, Me, Ph, Un
2. With 1 type (the longer type) of appendages only — A, Bl, Br, C, E, F, L, Mi, Pl, Po, Q, Sa, Sp, T, U

XI. Presence or absence of the mycelioid longer type appendages:

1. Mycelioid — Bl, Br, C, E, L, Sp
2. Nonmycelioid — A, Bu, F, Me, Mi, Ph, Pl, Po, Q, Sa, T, U, Un

XII. Morphology of the main stem of the longer type appendages:

1. Di- or tri-chotomously branched — A, Sa
2. Undulate — Me
3. With a bulbous base — Bu, Ph, Q
4. Club-shaped — T
5. Not as above — Bl, Br, C, E, F, L, Mi, Pl, Po, Sp, U, Un

XIII. Morphology of the apex of the longer type appendages:

1. Needle-shaped — Ph
2. Simply uncinata or helicoid — Bu, Pl, Q, Sa, U, Un
3. Uncinate or helicoid then di- or tri-chotomously branched — F
4. 1-several times dichotomously branched — Me, Mi, Po
5. Obtuse to somewhat pointed — A, Bl, Br, C, E, L, Sp,
T

XIV. Morphology of the shorter type appendages:

1. Capitate — Bu
2. Rod-shaped — Me
3. Penicillioid — Ph
4. Falcate — Un

DIAGNOSTIC KEY:

1. Anamorphic.....2
1. Teleomorphic or holomorphic.....5
2. Mycelia ectophytic; conidia generally in chains, or rarely single, doliform, doliform-cylindric to cylindric, relatively small.....Oidium
2. Mycelia subendophytic; conidia single, clavate, obclavate, or of other shapes, relative large.....3
3. Conidiophores developed from the endophytic mycelia and emerging through the stomata of the host, frequently branched.....Oidiopsis
3. Conidiophores developed from the superficial mycelia, usually unbranched.....4
4. Foot cells of the conidiophores twisted several times.....Streptopodium
4. Foot cells of the conidiophores straight and not twisted.....Ovulariopsis
5. Ascus single in an ascocarp.....6
5. Asci more than one in an ascocarp.....8
6. Tips of the appendages dichotomously branched several times.....Podosphaera
6. Tips of the appendages not branched.....7
7. Inner wall of the ascocarp undetachable from the outer wall; aerial setae absent.....Sphaerotheca
7. Inner wall of the ascocarp detachable from the outer wall; aerial setae present.....Cystotheca
8. With 2 types of appendages on the same ascocarp.....9
8. With only 1 type of appendages.....12
9. Longer type appendages with a bulbous base.....10
9. Longer type appendages without a bulbous base.....11
10. Tips of the longer type appendages needle-shaped; shorter type appendages penicillioid....Phyllactinia
10. Tips of the longer type appendages uncinata; shorter type appendages capitate.....Bulbouncinula

11. Longer type appendages not undulate, tips uncinatate;
shorter type appendages sickle-shaped...Uncinuliella
11. Longer type appendages strongly undulate, tips dichotomously branched; shorter type appendages rod-shaped.
.....Medusosphaera
12. Appendages mycelioid.....13
12. Appendages not mycelioid.....16
13. Ascocarps with outer wall only, composed of one layer
of cells.....Brasiliomyces
13. Ascocarps with outer and inner walls, each comprising
several layers of cells.....14
14. Mycelia subendophytic; conidia single; conidiophores
developed from the endophytic mycelia and emerging
through the stomata of the host.....Leveillula
14. Mycelia ectophytic; conidia in chains; conidiophores
developed from the superficial mycelia.....15
15. Ascocarps embedded in a mycelial mat; appendages rudimentary; conidiophores with a bulbous base..Blumeria
15. Ascocarps not embedded in a mycelial mat; appendages
usually well developed; conidiophores without a
bulbous base.....Erysiphe
16. Appendages regularly dichotomously or subdichotomously
branched several times.....17
16. Appendages usually not branched.....19
17. Appendages branching at the tips.....Microsphaera
17. Appendages beginning to branch at the middle portion.18
18. Appendages multiseptate; not uncinatate at the apex; with
one type of conidia and conidiophores only.....Arthrocladiella
18. Appendages usually not septate, uncinatate at the apex;
with macro- and micro-types of conidia and conidiophores.....Sawadaia
19. Appendages club-shaped.....Typhulochaeta
19. Appendages not club-shaped, hook-like or uncinatate at
the apex.....20
20. Mycelia subendophytic; asci arranged in hymenial layer;
ascocarps more or less turbinate.....21
20. Mycelia ectophytic; asci in fascicle; ascocarps de-
pressed-globose.....22
21. Appendages with a bulbous base; aerial setae present...
.....Queirozia
21. Appendages without a bulbous base; aerial setae absent.
.....Pleochaeta
22. Tips of the appendages uncinatate and not forked..Uncinula
22. Tips of the appendages at first uncinatate then forked...
.....Furcuncinula

ILLUSTRATED GENERA*

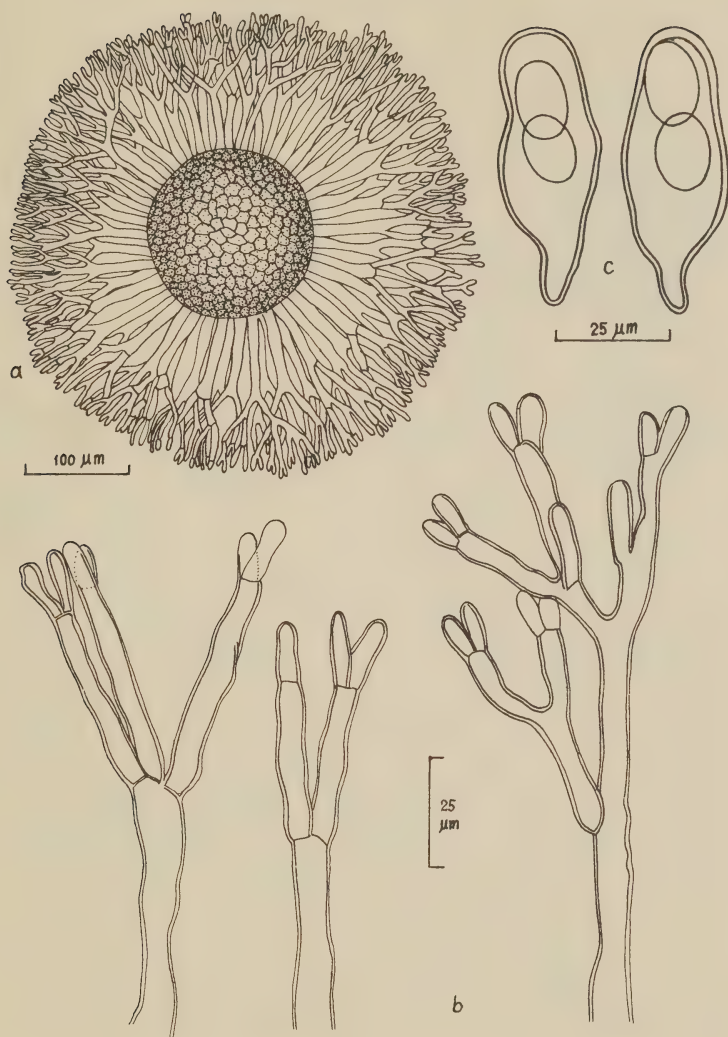


Fig. 10. ARTHROCLADIELLA

Arthrocladiella mougeotii (LÉV.) VASSILK.: a. ascocarp, b. appendages, c. asci & ascospores. (on *Lycium potaninii* POJARK., XJA-IAC 56)

* For illustrations of the anamorphic genera, see Fig. 3.

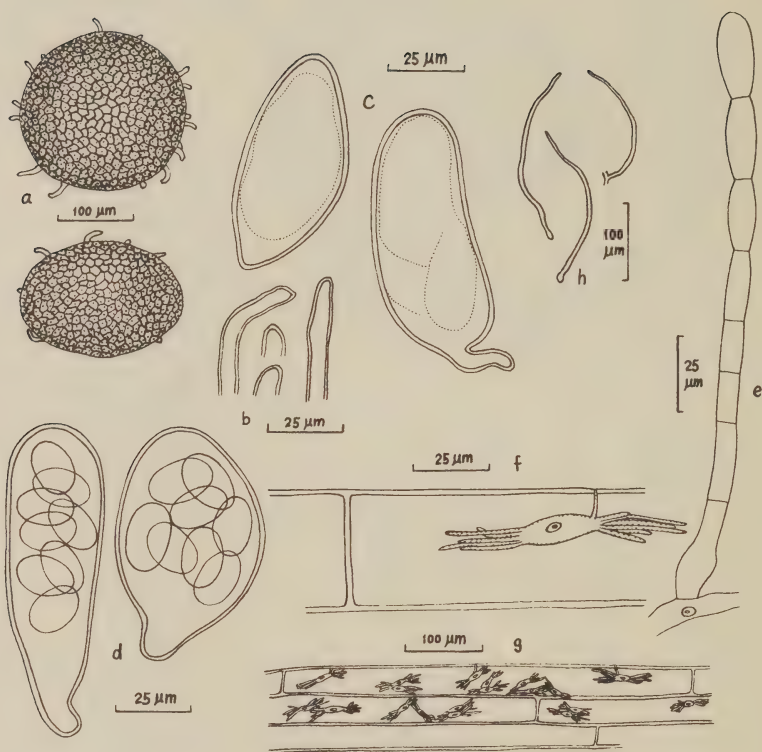


Fig. 11. BLUMERIA

Blumeria graminis (DC.) SPEER: a. ascocarps, b. appendages, c. immature asci, d. mature asci, e. conidiophore & conidia, f & g. haustoria, h. aerial setae. (on *Triticum aestivum* L., HMAS 40033 - a, b, c, h, XJA-IAC - e, f, g; on *Poa ianthina* KENG, HMAS 40028 - d)

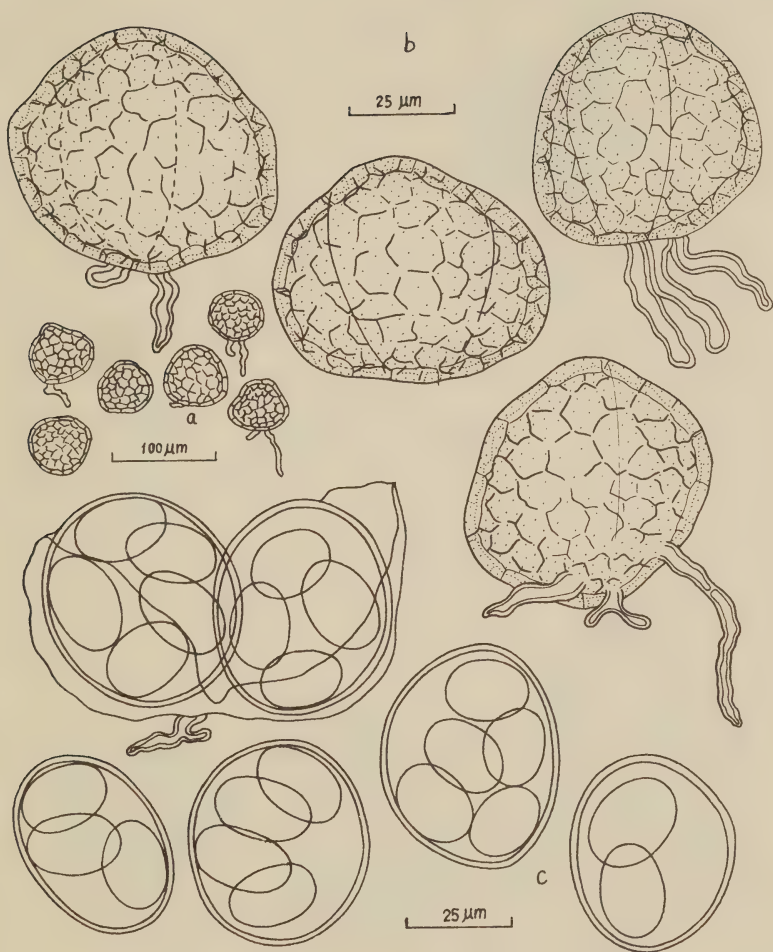


Fig. 12. BRASILIOMYCES

Brasiliomyces malachrae (SEAV.) BOESEW.: a & b. ascocarps, c. asci & ascospores. (on Malachra capitata L., NY 6488)

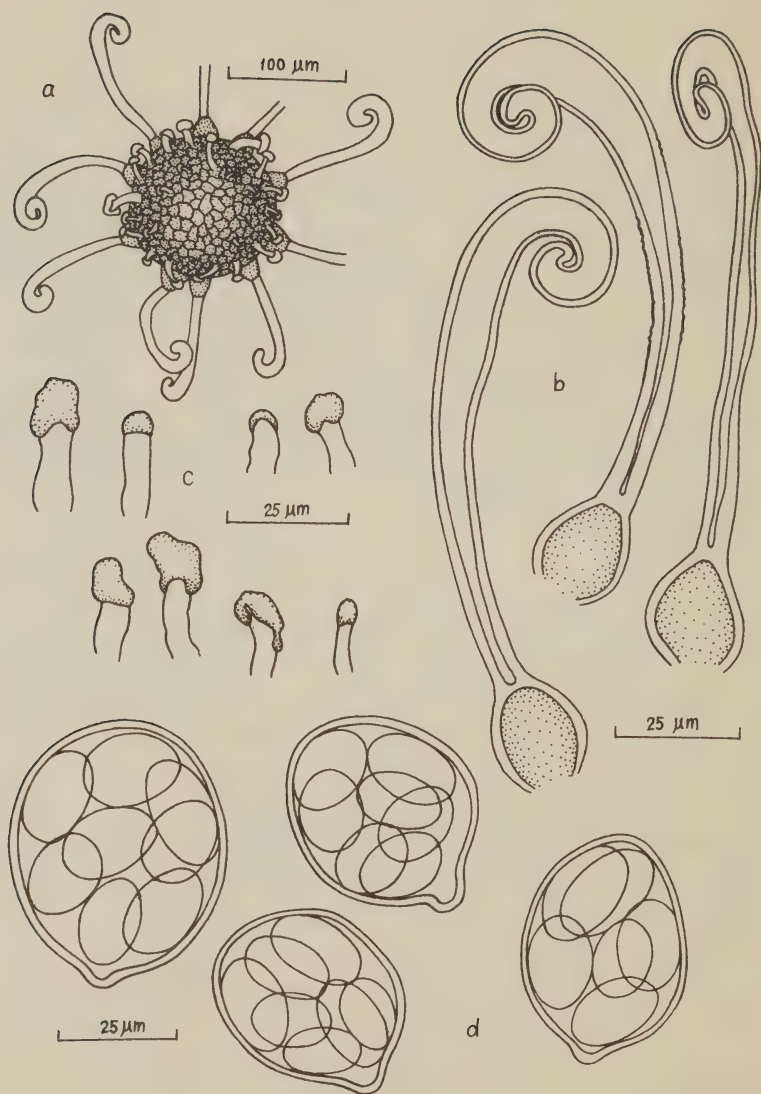


Fig. 13. BULBOUNCINULA

Bulbouncinula bulbosa (TAI & WEI) ZHENG & CHEN: a. ascocarp, b. longer type appendages, c. shorter type appendages, d. asci & ascospores. (on Koelreuteria paniculata LAXM., HMAS 11460)

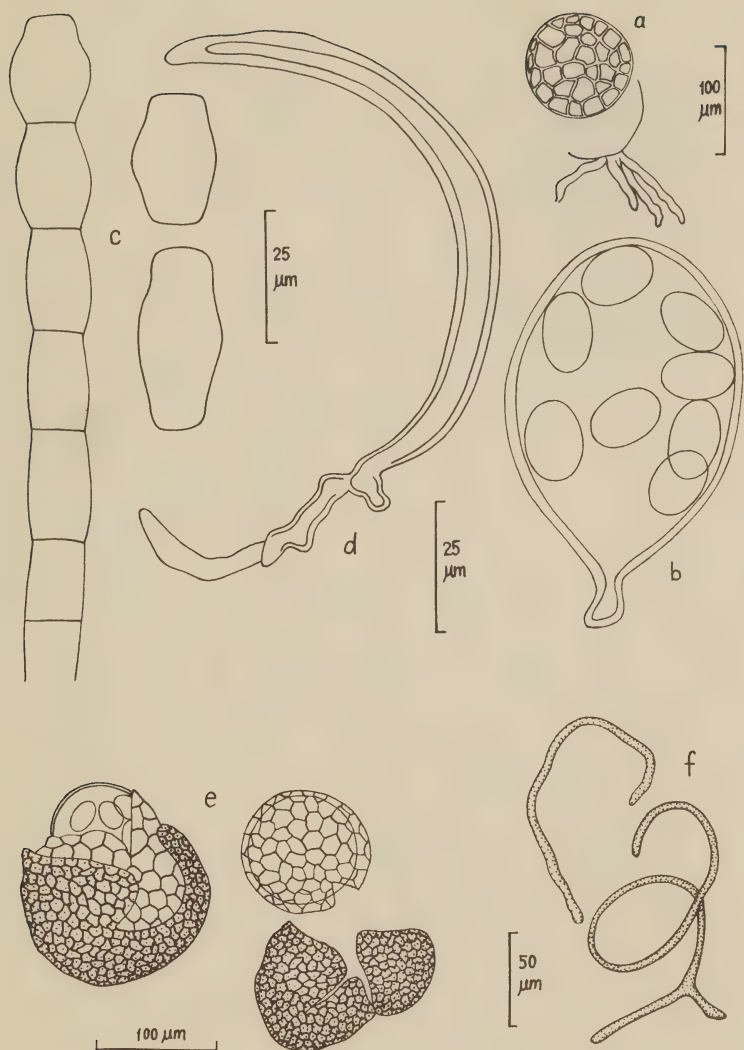


Fig. 14. CYSTOTHECA

Cystotheca wrightii BERK. & CURT.: a. broken ascocarp — inner wall detached from the outer wall, b. ascus & ascospores, c. conidiophore & conidia, d. aerial seta. (on *Quercus glauca* THUNB., HMAS 02912) *Cystotheca tjibodensis* (GXUM.) KATUM.: e. broken ascocarps — inner wall detached from the outer wall, f. aerial setae. (on *Castanea argentea* BR., BERN)

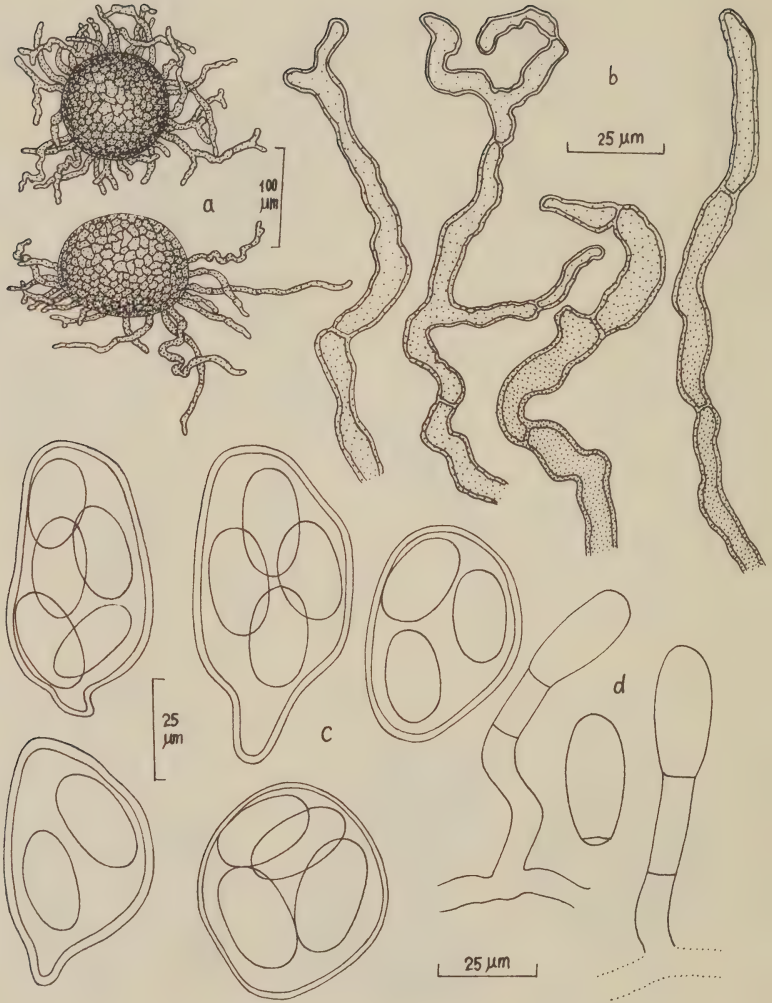


Fig. 15. ERYSIPHE

Erysiphe polygoni DC.: a. ascocarps, b. appendages, c. asci & ascospores, d. conidiophores & conidia. (on *Polygonum aviculare* L., HMAS 40223)

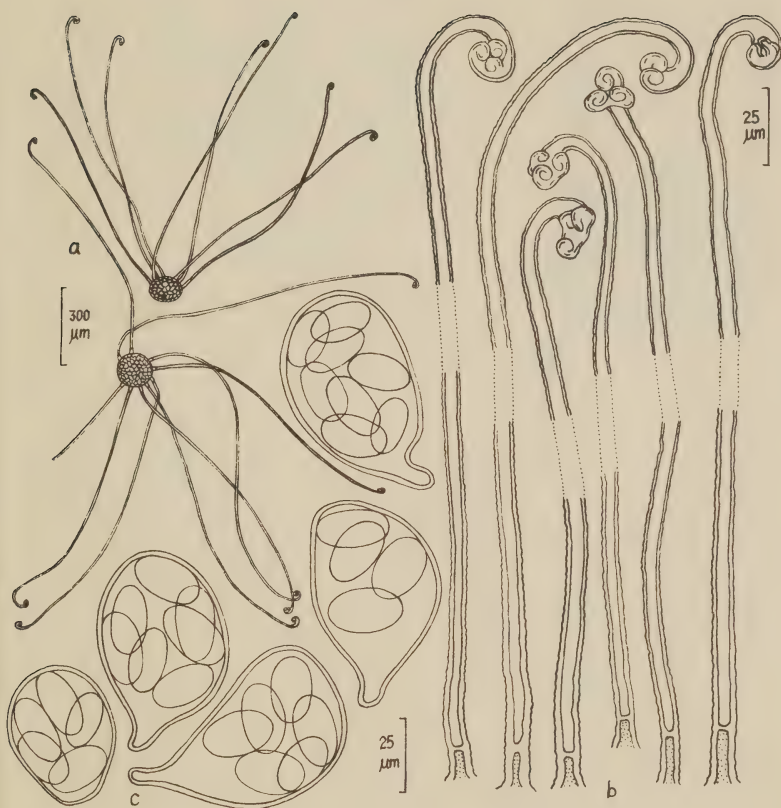


Fig. 16. FURCUNCINULA

Furcunculinula wuyiensis Z. X. CHEN & GAO: a. ascocarps, b. appendages, c. asci & ascospores. (on *Carpinus londoniana* H. WINKL., HMAS 41443)

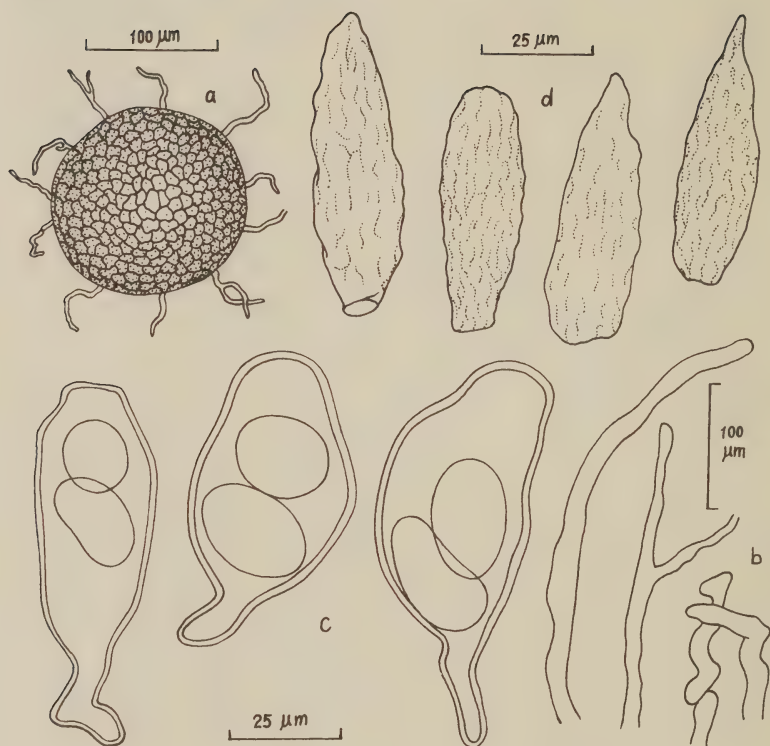


Fig. 17. LEVEILLULA

Leveillula taurica (LÉV.) ARN.: a. ascocarp, b. appendages, c. asci & ascospores, d. conidia. (on Peganum harmala L., HMAS 37623)

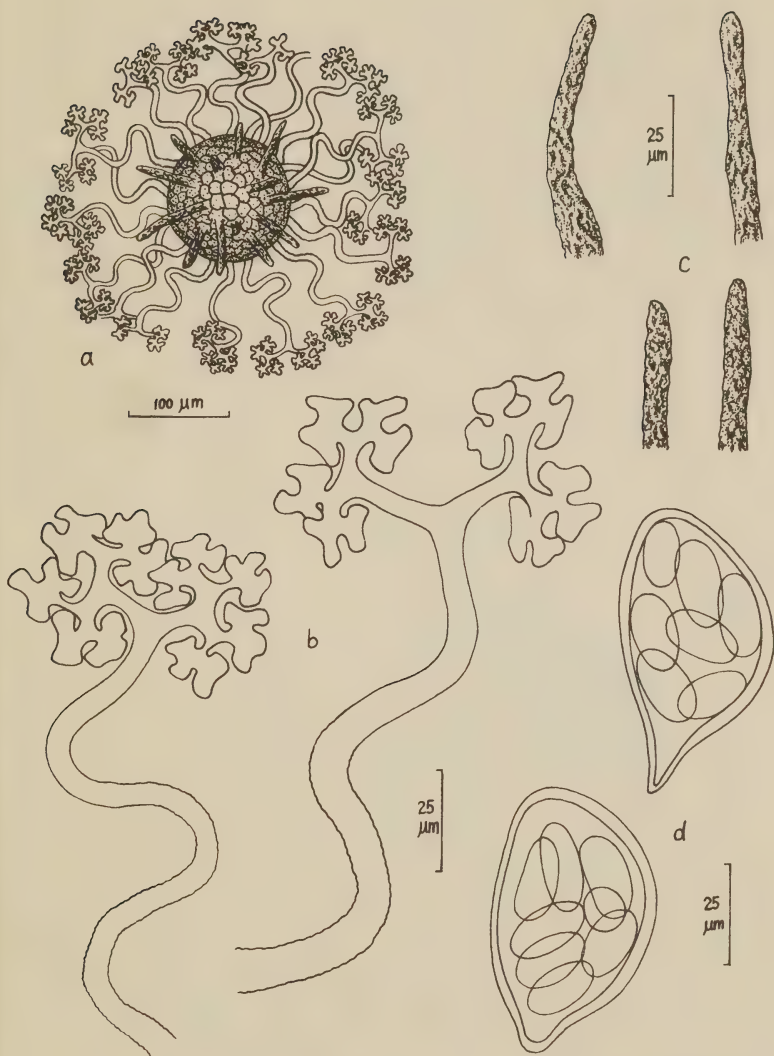


Fig. 18. MEDUSOSPHAERA

Medusosphaera rosae GOLOV. & GAMAL.: a. ascocarp, b. longer type appendages, c. shorter type appendages, d. asci & ascospores. (on Rosa alberta REGEL, HMAS 36517)

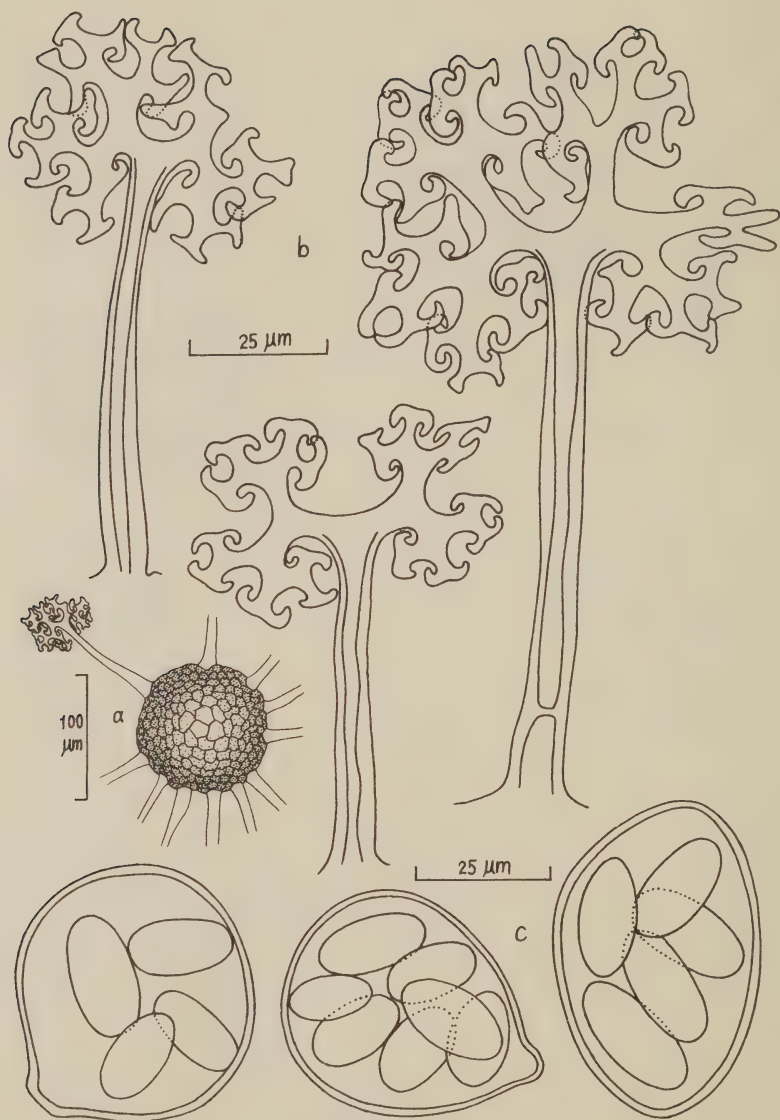


Fig. 19. MICROSPHAERA

Microspphaera friesii LÉV.: a. ascocarp, b. appendages, c. asci & ascospores. (on Rhamnus davurica PALL., HMAS 37644)

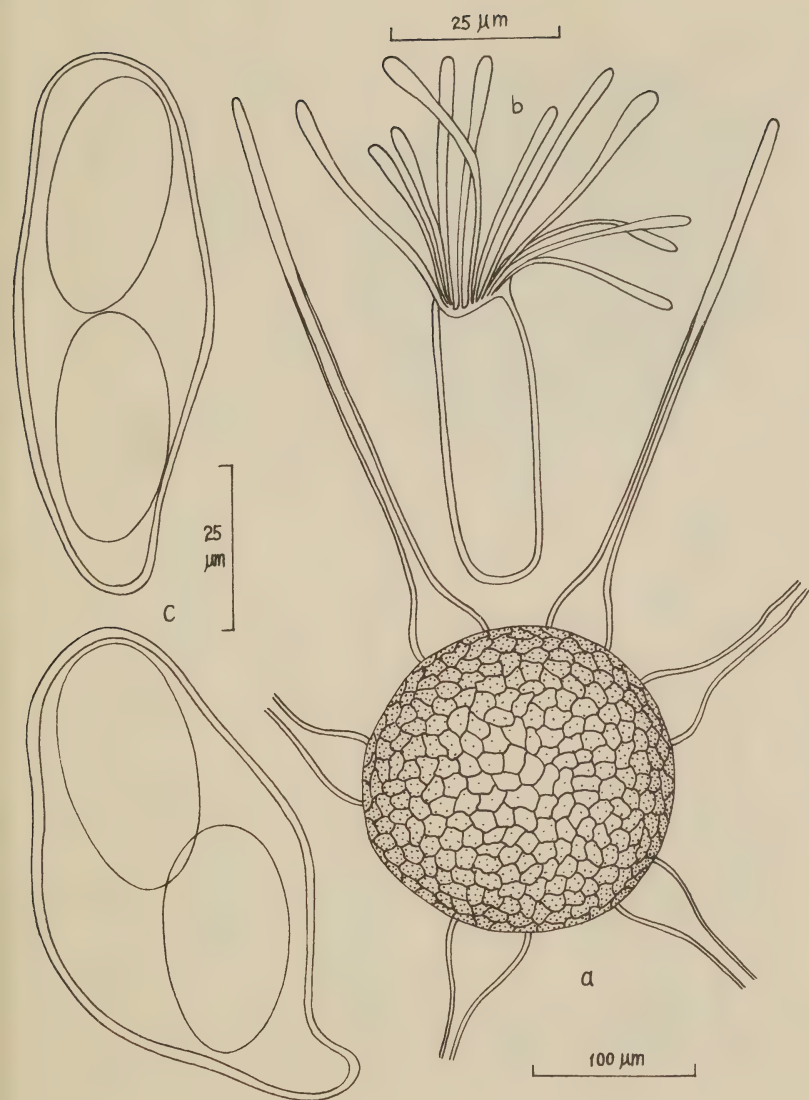


Fig. 20. PHYLLACTINIA

Phyllactinia guttata (WALLR.) LÉV.: a. ascocarp, b. shorter type appendages, c. asci & ascospores. (on Ostryopsis davidiana DECNE., HMAS 37131)

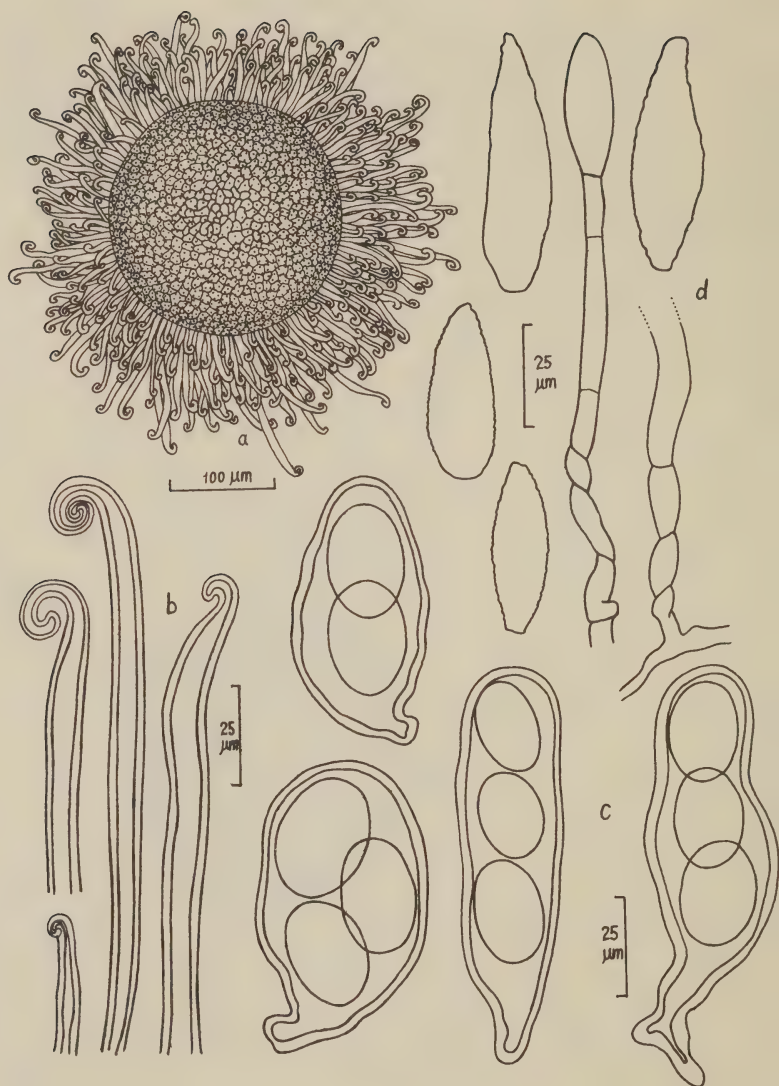


Fig. 21. PLEOCHAETA

Pleochaeta shiraiana (P. HENN.) KIMBR. & KORF: a. ascocarp, b. appendages, c. asci & ascospores, d. conidiophores & conidia. (on Celtis sinensis PERS., HMAS 00122 - a, b, c, HMAS 00123 - d)

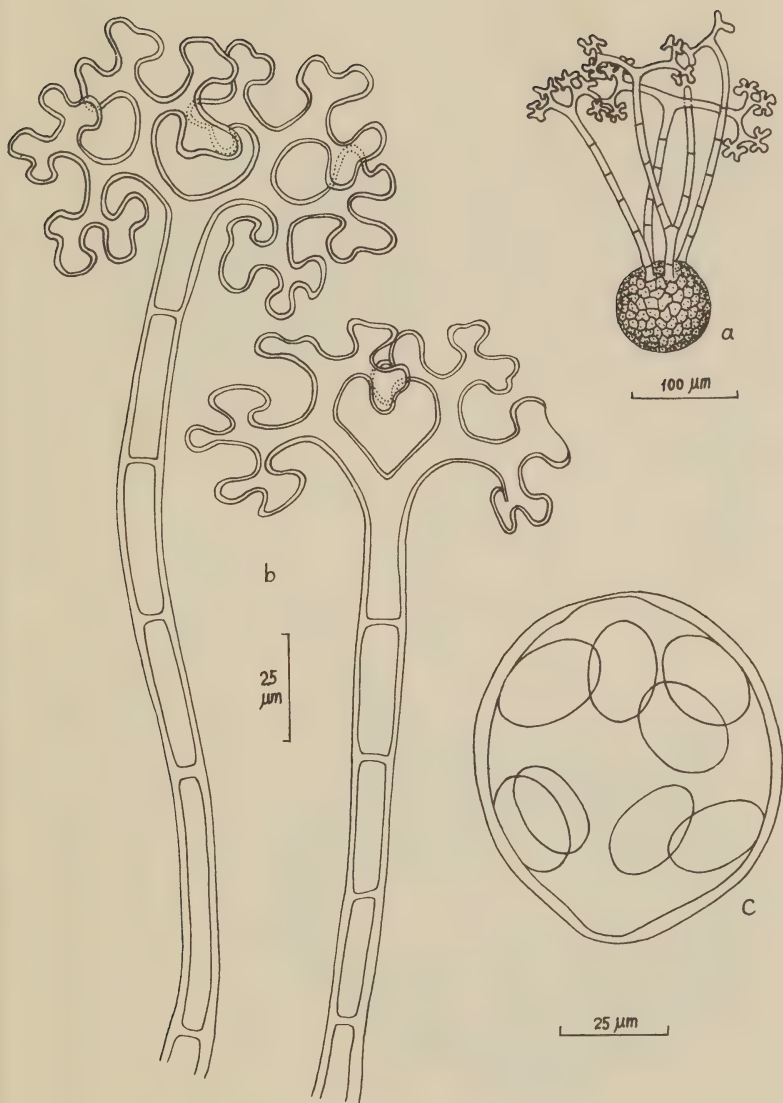


Fig. 22. *PODOSPHAERA*

Podosphaera tridactyla (WALLR.) de BARY: a. ascocarp, b. appendages, c. ascus & ascospores. (on *Prunus persica* (L.) BATSCH, HMAS 36536)

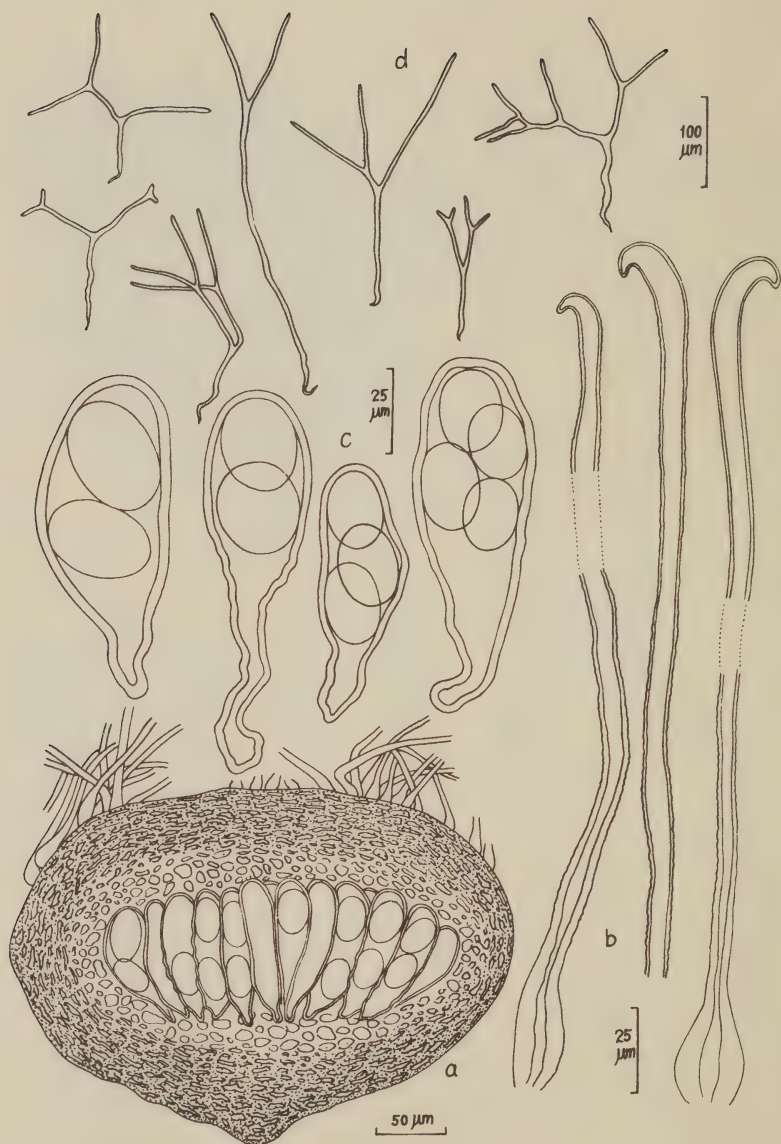


Fig. 23. QUEIROZIA

Queirozia turbinata VIÉGAS & CARDOSO: a. ascocarp, b. appendages, c. asci & ascospores, d. aerial setae. (on Platycamus regnelli BENTH., IACM)

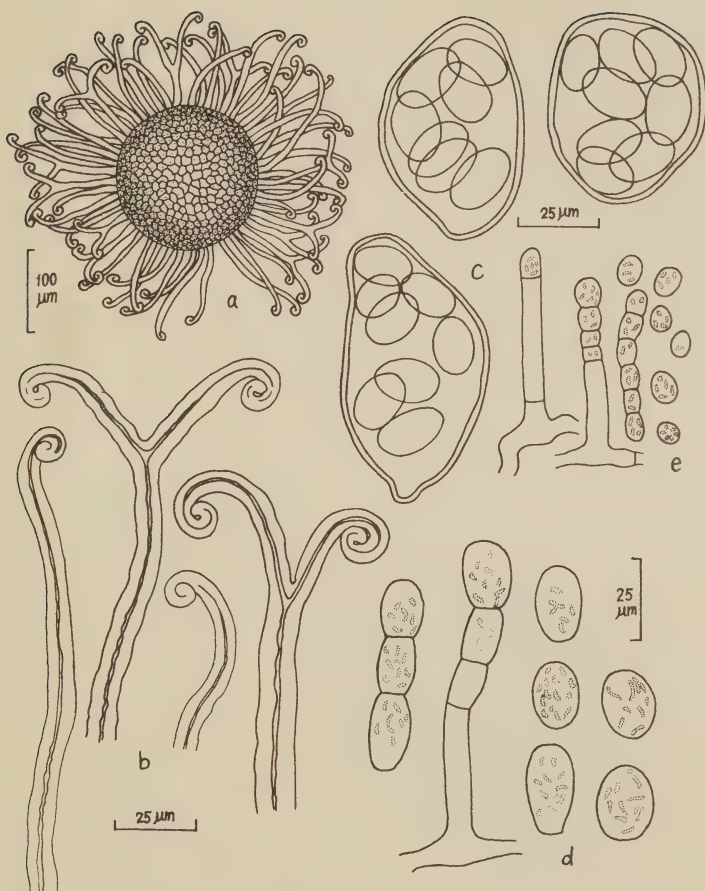


Fig. 24. SAWADAIA

Sawadaia tulasnei (FUCK.) HOMMA: a. ascocarp, b. appendages, c. asci & ascospores, d. macro-type conidiophore & conidia, e. micro-type conidiophores & conidia. (on Acer sp., HMAS 40312 - a, b, c; on Acer truncatum BUNGE, HMAS 13615 - d, e)

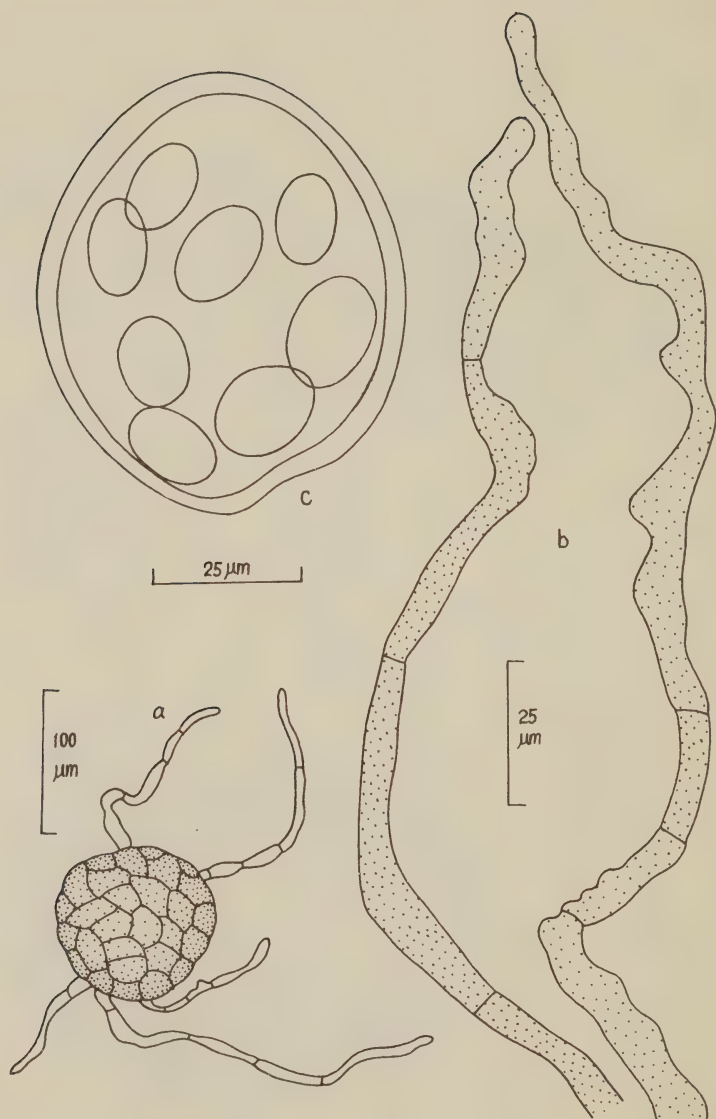


Fig. 25. SPHAEROTHECA

Sphaerotheca balsaminae (WALLR.) KARI: a. ascocarp, b. appendages, c. ascus & ascospores. (on *Impatiens balsamina* L., HMAS 31546)

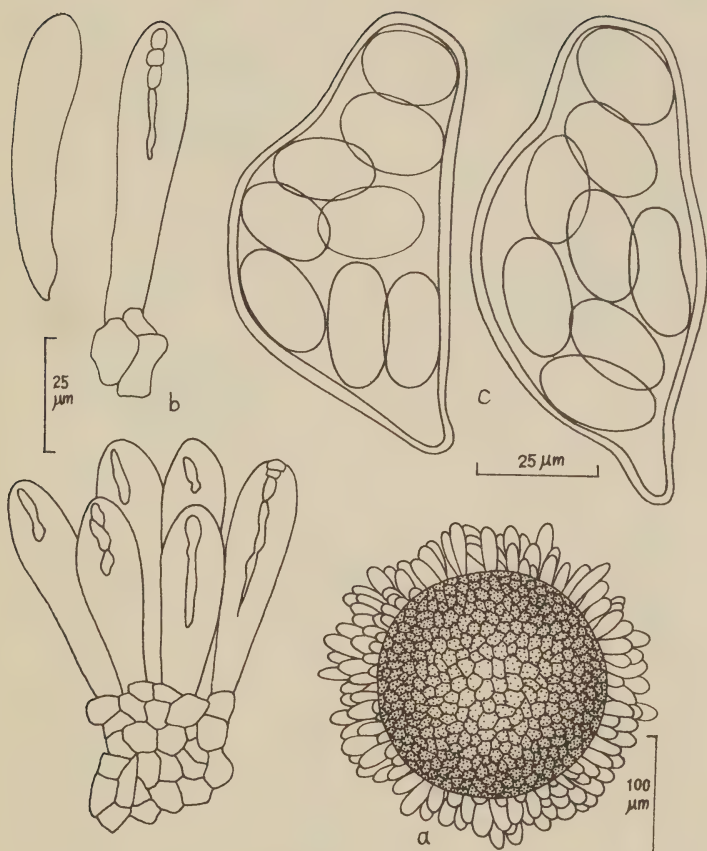


Fig. 26. TYPHULOCHAETA

Typhulochaeta japonica ITO & HARA: a. ascocarp, b. appendages, c. asci & ascospores. (on Quercus sp., HMAS 11242)

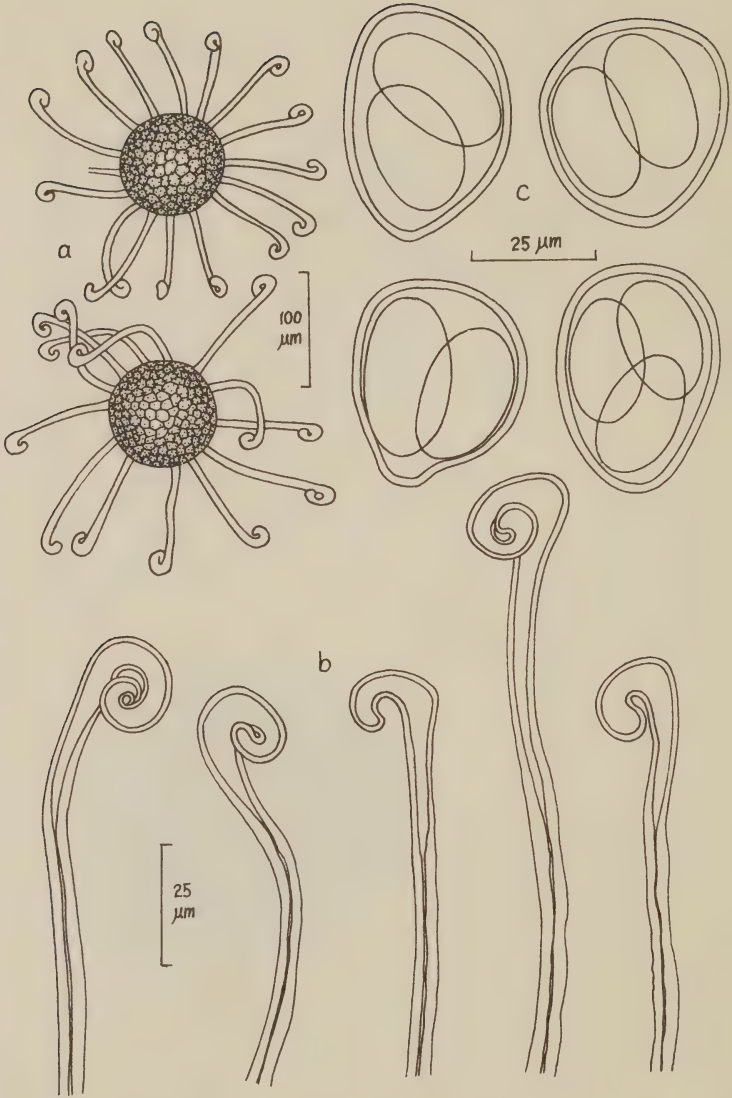


Fig. 27. UNCINULA

Uncinula clandestina (BIV.-BERN.) SCHROET.: a. ascocarps, b. appendages, c. asci & ascospores. (on Ulmus parvifolia JACQ., HMAS 11457)

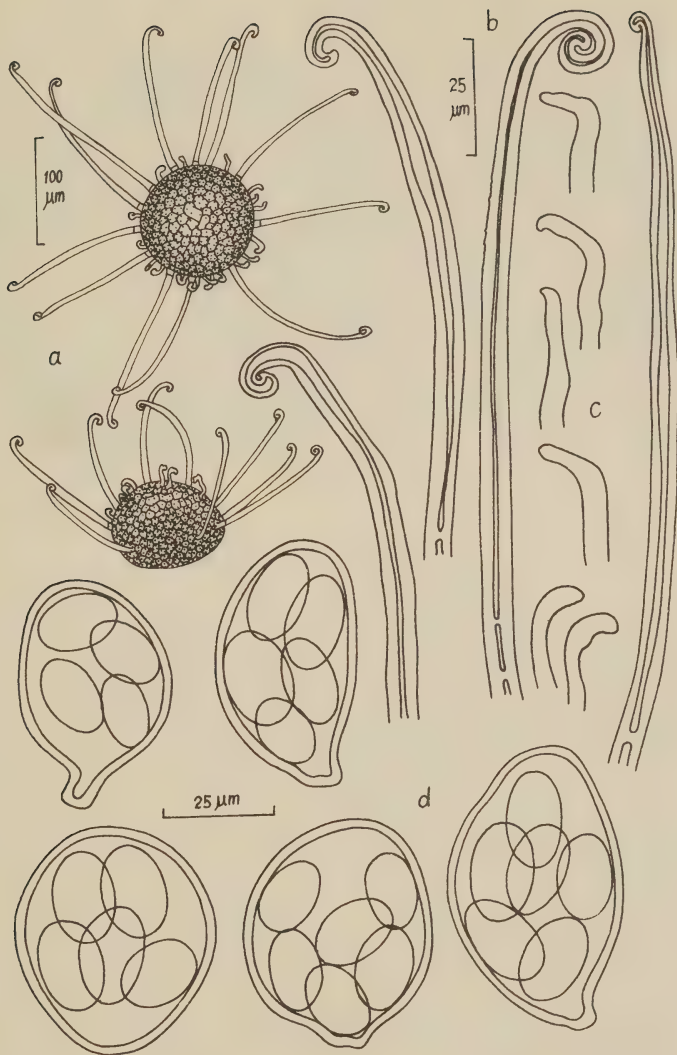


Fig. 28. UNCINULIELLA

Uncinuliella simulans (SALM.) ZHENG & CHEN var. rosae-rubi
 ZHENG & CHEN: a. ascocarps, b. longer type appendages, c. shorter type appendages, d. asci & ascospores. (on Rosa rubus LÉVL & VANT., HMAS 11418)

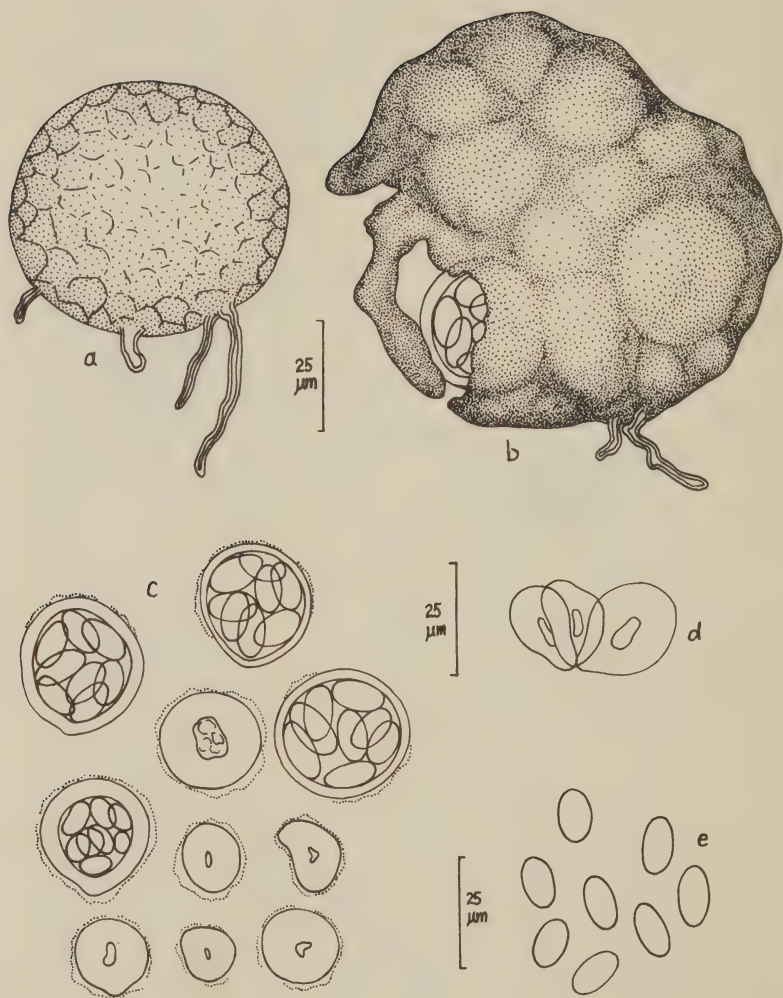


Fig. 29. XENOMYXA (doubtful genus)

Xenomyxa disseminata SYD.: a. immature ascocarp, b. mature ascocarp, c. asci from a single ascocarp, d. 3 immature asci in a fascicle, e. ascospores. (on Alsophila hirta KLF., S 1147)

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SOWERBYELLA IMPERIALIS (PECK) KORF IN ESTONIA

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Sowerbyella imperialis is a rare fungus found in U.S.A. (Peck, 1878), Sweden (Nannfeldt, 1938; Eckblad, 1968), France and Switzerland (Svrček, 1969; Moravec, 1973); in the Estonian SSR it was found for the third time recently. A description of the Estonian collections is presented here.

Sowerbyella imperialis (Peck) Korf, *Phytologia* 21: 206 (1971).

Figs. 1-3.

Apothecia terrestrial, stipitate, cupulate, externally hairy, diameter 4-9 cm, stipe 20-30 x 5-7 mm, external side of hymenium and that of apothecium golden-yellow all over. Hymenium consists of cylindrical asci and clavate paraphyses, all of the same height, (185-)190-200(-210) μm . Diameter of the paraphysis apex (3.2-)3.8-7.3(-8.2) μm . Asci eight-spored. Spores ellipsoid, hyaline (12.0-)12.5-12.8(-13.2) x (5.7-)6.0-6.5(-6.9) μm , length/width = 2.1. Ornamentation of spores microverrucose. Hypothecium 130-150 μm thick. Ental excipulum (medulla) 190-200 μm thick of textura intricata, consisting of thin-walled interwoven hyaline hyphae (4.8-)8.0-9.6(-11.2) μm broad. Ectal excipulum 130 μm thick of textura angularis, composed of larger hyaline cells (16-)24-32(-37) x (24-)40-42(-56) μm . The outer surface of ectal excipulum of textura globulosa is composed of thick-walled cells, staining strongly in Cotton blue. Out of these cells arise hyphoid, obtuse hairs with 1-3 septa, (32-)66-77(-96) μm long and (6.4-)7.5-8.2(-9.6) μm broad.

Material examined: Estonian SSR, Harju District, Vasa-lemma, on the ground, 25.IX.1957, H.-E. Rebassoo, TAA 6589; Rakvere District, Vinni, on an alvar, 7.X.1970, A. Roos, TAA 60856; Kingissepa District, Muhumaa Isl., Suuremõisa, in a juniper stand, on the ground, 6.X.1983, M. Vaasma, TAA 115731.

Compared to previously known specimens, our no. 115731 is conspicuous by its larger apothecia up to 9 cm in diameter.

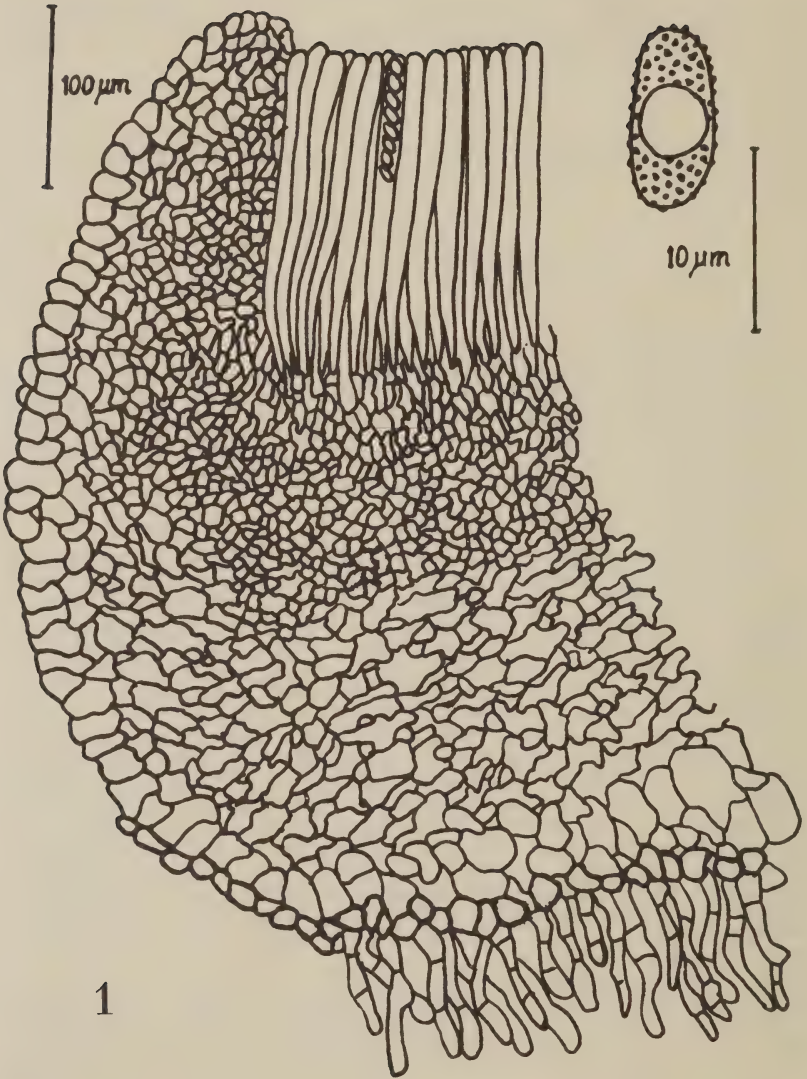


Figure 1. Cross-section of an apothecium and one ascospore.



Figure 2. Apothecia of *Sowerbyella imperialis*, x2.

Figure 3. Spores of *Sowerbyella imperialis* (scale-line = 2 μ m).

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STUDIES ON CHINESE ASCOMYCETES. 1. PHAEOSACCARDINULA DICTYOSPORA.

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SUMMARY

Phaeosaccardinula dictyospora (Petr.) comb. nov. (syn. **Chaetothyrium dictyosporum** Petr.) is the only species in the genus known from China. All epithets that have been used in the genus are discussed.

INTRODUCTION

The genus **Phaeosaccardinula** P. Henn. (1905: 67) is characterized by epiphyllous, superficial, uniloculate, perithecioid ascomata, which are usually described as being covered by a thin, non-setose pellicle, centrum of saccate, bitunicate asci producing muriform, hyaline - brownish ascospores. More than 30 epithets have been used under this generic name, but many of the species belong in other genera (**Limacinula**, **Treubiomyces**; Reynolds 1971, 1983). There is, however, no modern study of all species in the genus, so the position of some of them is uncertain.

Two species of **Phaeosaccardinula** have been reported from China, viz. **P. javanica** (Zimm.) Yamam. and **P. longispora** Yamam. Neither of them belongs in the genus. The former species is **Limacinula javanica** (Zimm.) Höhn., the latter

one is **Treubiomyces roseosporus** (Höhn.) Reyn. (see below). However, **Chaetothyrium dictyosporum** Petr., described from the Kwangsi Prov., has not hyaline phragmospores as other **Chaetothyrium** spp., but is a true **Phaeosaccardinula**. It differs from all species previously placed in the genus. Two species from Brazil with similar spores (see below) were described much later than **C. dictyosporum** and do not affect the nomenclature of this species, if they would be considered conspecific with it.

Phaeosaccardinula dictyospora (Petr.) O. Erikss. & J. Yue
comb. nov.

Basionym: **Chaetothyrium dictyosporum** Petrak in Acta Horti
Gotob. 17: 133 (1947).

This species was found by Petrak on herbarium material of **Ficus** sp. from China (Kwangsi Prov., Chiu Fung Yun Hsien, alt. ca. 1500 m. 9.V.1933, leg. A.N. Steward & H.C. Cheo 372, W). The fungus grows on the upper surface of living leaves. We have examined semithin sections of one ascoma (embedded in glycol methacrylate - Historesin, and sectioned on an LKB Ultratome 4801 A) and squash mounts of the type. The following description gives only the most important details of the morphology of the species. Our observations agree with Petrak's detailed description in most parts, but some important details have been added.

Ascomata superficial, perithecioid, depressed, with a thin superficial, non-setose, tessellate scutellum, which is circular - broadly elliptical in outline, and ca. 750 μ m across; central parts of scutellum ca. 20 μ m thick, outermost layers of rather short, dark-walled cells, inner layers of more elongated, straight, subpericlinal, radiating, dark-walled cells, which continue into hyaline, thin-walled cells lining the ascomal cavity and cells filling out the space between scutellum, ascomal cavity and epidermis of leaf; marginal, clypeus-like, free parts of scutellum ca. 200 μ m broad, proximally ca. 20 μ m thick, distally thinner and finally a dense, ca. 5-10 μ m thick network of 1-2 layers of hyphae; the central pore ca. 30 μ m high, and ca. 25 μ m wide in proximal and distal parts, ca. 20 μ m wide in the middle part and here surrounded by a ring-like zone of small angular, rather thin-walled cells (Fig. 2A), pore filled with ⁺gelatinized cells, probably originating in part from cells lining the locule; locule ca. 280 μ m wide and 70 μ m high, roofed by hyaline cells

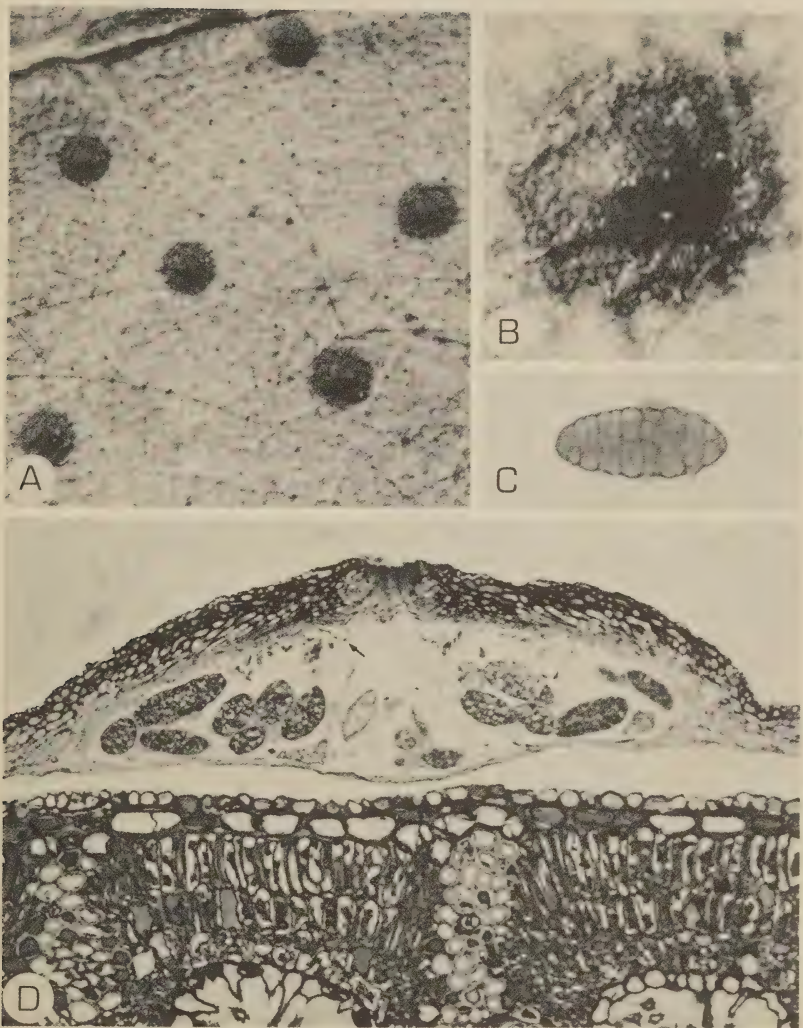


Fig. 1. *Phaeosaccardinula dictyospora*. - (A) Scattered ascomata on leaf. (B) Ascoma; scutellum with clypeus-like margin. (C) Ascospore. (D) Median section through ascoma. Note the hamathecium (arrow) and the ring-like zone of more thin-walled cells around the pore. - (A) X 14. (B) X 60. (C) X 475. (D) X 300.

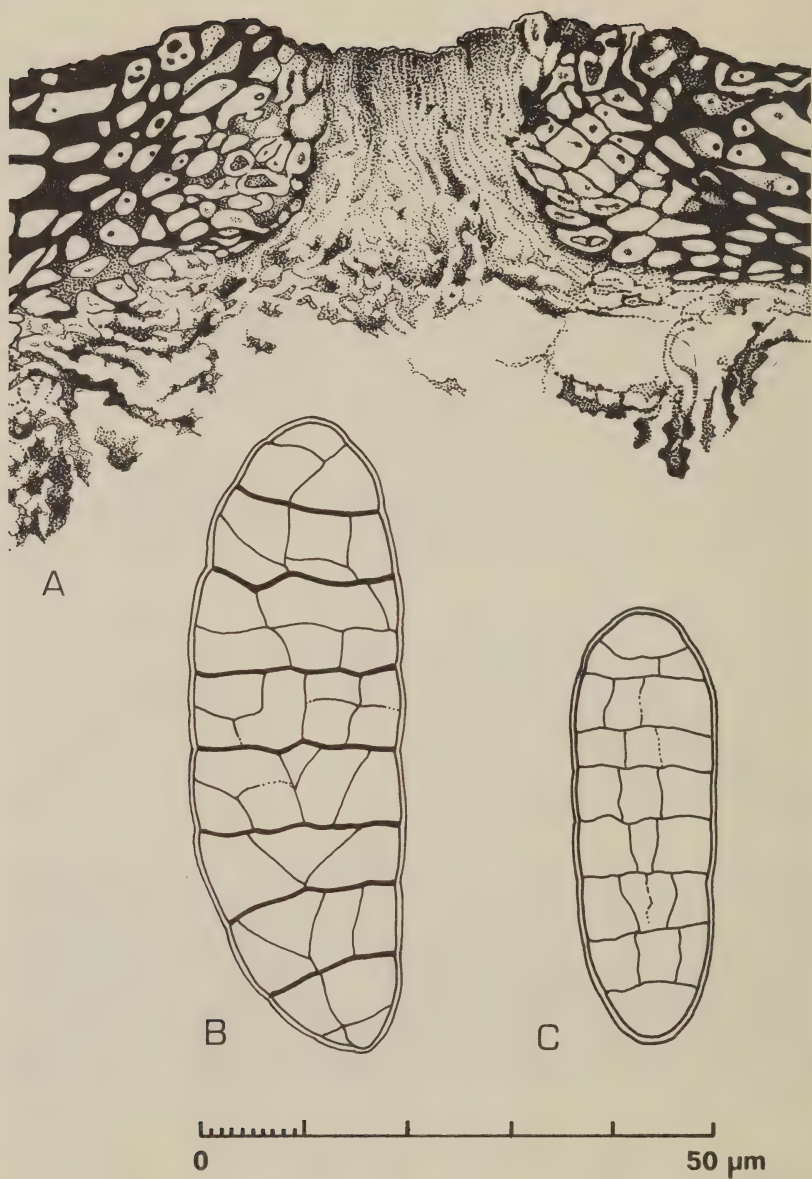


Fig. 2. (A, B) *Phaeosaccardinula dictyospora*. (C). *P. pipericola*. - (A) Ostiole with $^{+}$ gelatinized hamathecial cells. (B, C) Ascospores.

producing a hamathecium of sparse ?pseudoparaphyses or ? periphysoids (at least near the ostiole) and laterally and basically lined by a thin wall of a few layers of flattened, hyaline cells, all originating from the overlaying, innermost layer of the scutellum; asci bitunicate, cylindric clavate, short-stalked, KOH/IKI+ blue, 4-6-spored; ectotunica thin (easily broken in squash mounts), endotunica thick; ascospores ca. 35-61 x 16-24 μ m, ellipsoidal, slightly inequilateral, light brown, divided by usually 7 A-transsepta and some longisepta, and in at least some segments also by B-transsepta, without distinct perispore.

DISCUSSION

Sections of ascomata of **Phaeosaccardinula dictyospora** (Fig. 1D) show that 1) the wall surrounding the locule in each ascoma originates from the lower surface of the covering scutellum, 2) a lysigenous pore is formed in the scutellum, and 3) there is a hamathecium of ?periphysoids (at least near the pore, or ?pseudoparaphyses in the rest of the locule). The ontogeny of the closely related **Treubiomyces pulcherrimus** has been studied by Pohlad (1980) and discussed by Reynolds (1983: 349). They have appropriately described the marginal part of the scutellum as a clypeus. The hamathecium should consist of periphysoids. As in *P. dictyospora*, the asci are KOH/IKI+ blue. The development is not quite similar to that described in the "hemisphaerial" Microthyriaceae (e.g., **Myiocopron smilacis** (De Not.) Sacc.; Luttrell 1944). The family Chaetothyriaceae should be kept for a group of genera (**Chaetothyrium**, **Ceramothyrium**, **Phaeosaccardinula**, **Treubiomyces**, etc.) that Reynolds has characterized as "foliicolous capnodiaceous fungi with a clypeated ascocarp".

The following is a list of all epithets that have been used in **Phaeosaccardinula**. Our studies of material and/or literature indicate that none of these epithets refers to our species, **P. dictyospora**. We have tried to indicate the correct specific name for each epithet and the differences between **P. dictyospora** and the other species in the genus. Some of the names in **Phaeosaccardinula** are used only provisionally until original material has been examined, but all these names are younger than **Chaetothyrium dictyosporum** and a restudy of these species will not result in

any change of name of our species. The host(s) given in the original description of each species is mentioned in the list.

1. amapensis Bat. & Silva

Host: indet. leaves. (Batista & al. 1967: 159).

The ascospores are cylindrical and much longer than in *P. dictyospora*. They may have up to 33 transsepta and only one longiseptum in some segments.

2. anomala (Cooke & Harkn.) Miller & Bonar = *Limacinula anomala* (Cooke & Harkn.) Reyn.

Host: *Laurus* sp. (Reynolds 1971: 1186).

3. butleri (Syd.) Theiss. & Syd. = *Limacinula butleri* Syd.

Host: *Artocarpus mysorensis*. (Reynolds 1971: 1189).

4. canthii (Hansf.) Hansf.

Hosts: *Canthium* sp., etc. (Hansford 1946: 154-155).

The spores are usually longer and narrower and divided by more transsepta than in *P. dictyospora*.

5. caucasica (Woron.) Hansf. = *Limacinula javanica* (Zimm.) Höhn.

Host: *Taxus baccata*. (Reynolds 1971: 1192)

6. caucasica (Woron.) Hansf. var. *artocarp*i Bat., Nascim. & Cif. = ?*Limacinula*

Host: *Artocarpus integrifolia* (Batista & Ciferri 1962: 84).

7. ceibae (Petr. & Cif.) Bat. & Cif.

Host: *Ceiba pentandra*. (Bat. & Cif. 1962:86).

The size and septation of the spores in this species agree very closely to our observations of *P. dictyospora*. We have not seen material of *P. ceibae* and cannot decide whether the two species are conspecific. However, if they are, *Chaetothyrium dictyosporum* is the older name and has priority.

8. coumae Bat. & Vital

Host: *Couma utilis*. (Bat. & Cif. 1962: 10, as *Batistella coumae* (Bat. & Vital) Cif.).

The spores are usually longer and broader than in *P. dictyospora* and divided by more transsepta.

9. dematia Miller & Bonar

Host: *Baccharis pilularis*. (Miller & Bonar 1941: 411).

The original material consists of *Baccharis pilularis* with twigs and leaves covered by a dense dematiaceous mycelium. This mycelial mass should produce "globose, collabent, ostiolate, somewhat tuberculate" ascomata with muriform ascospores of *P. dematia*, and "dark brown, subulate, simple or branched" pycnidia with "brown, flexuous, acuminate, greatly elongated" conidia (Miller & Bonar l.c. and Pl. 67,

Figs. 8 and 9; Note: 8 and 9 should be switched). We could not find any ascomata or pycnidia matching the description in the isotype (California Fungi 661, Moss Beach, San Mateo County, H.E. Parks 2139, 17.IV.1924, S). However in another number of "California Fungi" (796, N. end of Wildcat Canyon, Contra Costa County, L. Bonar, 21.IV.1931, S) we found narrowly conical pycnidia of a **Phaeoxyphiella** sp. with conidia of just the same type as described by Miller & Bonar. One species in this genus is considered the anamorph of **Capnodium walteri** Sacc. (Hughes 1976: 723-725). We found two types of ascomata with mature spores. One was shiny black and somewhat stalked and produces bitunicate asci with muriform ascospores, which were shorter than the length given by Miller & Bonar for **P. dematia**. The other fungus had small, globose, smooth ascomata containing bitunicate asci with 8, ellipsoidal, inequilateral, (2-) 3-septate, brown ascospores, measuring 11-14 x 5-6 μm . We have seen at least one more species in the material, but with immature asci. Capnodiaceous hyphal mats often consist of a mixture of species (Hughes 1976: 700), as was also found in this collection of **P. dematia**. More studies are needed before we can classify **P. dematia**, but it is in any case clear that this species does not belong in **Phaeosaccardinula**.

10. dictyospora (Petr.) O. Erikss. & J. Yue, this paper.

11. diospyricola P.Henn.

Host: **Diospyros** sp. (Reynolds 1971: 1175).

This is the type species of **Phaeosaccardinula**. Reynolds studied a slide of the original material filed in FH. He could not find any ascomata of this species in the specimen packet, only ascomata of **Micropeltis applanata** Mont., which also Hennings (1905: 67) had found in the same collection. We have seen another part of the same collection ("E. Ule. Herbarium Brasiliense. Amazonas-Expedition. No. 6471. **Phaeosaccardinula diospyricola** P. Henn., auf **Diospyros**, Peru, Rio Amazonas, Tarapoto, 9.1902", S). It consists of three leaves. We found two species with flattened ascomata. One has a bluish ascomal wall in the light microscope (black in the dissecting microscope) and hyaline phragmospores. This is **Micropeltis applanata**. The other species has a brown ascomal wall (in both the light and dissecting microscope) and immature, hyaline spores measuring ca. 17-20 x 6 μm and divided by 5 transsepta. This may be immature **P. diospyricola**. The original description of this species gives the spores as 7-13-septate, interrupted muriform and measuring 35-60 x 7-10 μm , i.e. they should be narrower and be divided by more numerous transsepta than in

P. dictyospora. Hennings' description and illustration of the type species **P. diospyricola** are not very detailed, but the current concept of **Phaeosaccardinula** is certainly correct.

12. epicarpa Bat., Nascim. & Cif.

Host: **Citrus grandis**. (Bat. & Cif. 1962: 87).

The spore measures of **P. epicarpa** and **P. dictyospora** overlap, but the spores have fewer A-transsepta in **P. epicarpa**.

13. ficicola P. Henn.

Host: **Ficus** sp.

We have examined original material ("**Phaeosaccardinula ficicola** P. Henn. Auf Ficus spec. Ost-Usambara, Amani. 1.1903. leg. Zimmermann", S) consisting of three fragments of leaves. On their upper sides are brown patches of a very thin mycelium. Numerous ascomata are to be found on this mycelium, but the same type of ascomata are also seen between the brown patches. They are circular in outline and often with collapsed ostiolar region. The bitunicate asci produce cylindric fusiform, often mucronate, hyaline phragmospores. We have identified this fungus as **Zukalia transiens** Höhn., which was described from the same material from Tanganyika. Von Höhnelt (1910: 917) mentions that the subiculum produces conidia of **Triposporium**. Such conidia are common in the collection we have studied. According to von Höhnelt (1910: 915-916) the ascomata of **Z. transiens** and **P. ficicola** are very similar. We have not been able to find any ascomata with well-developed dictyospores. Dr. Å. Strid has kindly informed us that there is no original material of **Z. transiens** in S. Such a collection might have contained also **P. diospyricola**. - **P. ficicola** was described from the same host genus as **P. dictyospora**, but they can hardly be conspecific, as the ostiolar region of the former species should be of the same type as in **Limacinula** (von Höhnelt incorrectly considered **Phaeosaccardinula** and **Limacinula** congeneric; see Reynolds 1971: 1173).

14. ficina (Syd.) Hansf. = **Limacinula samoensis** Höhn.

Host: **Ficus** sp. (Reynolds 1971: 1197).

15. funtumiae (Hansf.) Hansf. = **Treubiomyces funtumiae** (Hansf.) Reyn.

Host: **Funtumia** sp., etc. (Reynolds 1983: 352).

16. gigantospora Bat. & Matta

Host: **Manilkara zapota** (M. "sapodilla"). (Bat. & Cif. 1962: 89).

The spores are longer and broader than in **P. dictyospora**. They should be divided by 12-22 transsepta (i.e. A- and B-transsepta), which is more than in the latter species.

17. guajavae Bat. & Vital = **Limacinula musicola** (Bat.) Reyn.

Host: **Psidium guajava**. (Reynolds 1971: 1194).

18. guajavae Bat. & Vital var. **citrina** Bat. = **Limacinula musicola** (Bat.) Reyn.

Host: **Citrus aurantium**. (Bat. & Cif. 1962: 91).

19. jasmini Hansf.

Host: **Jasminum** sp. (Hansford 1946: 154-155; Reynolds 1983: 356).

The spores are much smaller and have fewer septa than in **P. dictyospora**.

20. javanica (Zimm.) Yamam. = **Limacinula javanica** (Zimm.) Höhn.

Host: **Coffea liberica**, etc. (Reynolds 1971: 1190).

This species has been reported on 73 different hosts from China (Tai 1979: 264). The material may represent more than one **Limacinula** species and should be restudied.

21. longispora Yamam. = **Treubomyces roseosporus** (Höhn.) Reyn.

Host: **Citrus maxima**. (Reynolds 1983: 354).

This species was described from Taiwan by Yamamoto (1956: 169).

22. malloti (Rehm) Theiss. & Syd. = **Limacinula samoensis** Höhn.

Host: **Mallotus philippinensis**, etc. (Reynolds 1971: 1197).

23. marsileae Rao = ?

Host: **Marsilea quadrifolia**. (Rao 1962: 349).

This fungus is certainly not a **Phaeosaccardinula** sp. The ascomata should not be covered by any scutellum in **P. marsileae**, and the ascospores should be divided by only 3 transsepta and have one longiseptum in one or two segments. Also the host species indicates that this species belongs in another genus. No other **Phaeosaccardinula** species has been reported on a pteridophyte.

24. martini (Ellis & Sacc.) Höhn. = ?

Host: **Quercus laurifolia**.

The spores should measure $24 \times 7 \mu\text{m}$ and should be divided by 4 transsepta and one longiseptum (von Höhnelt 1915: 58).

25. monosporica Bat. & Cif.

Host: **Manilkara zapota** (M. "sapodilla"). (Bat. & Cif. 1962: 92).

Each ascus contains only one ascospore. The spores are much longer than in **P. dictyospora**.

26. morindae Mend. = **Limacinula theae** Syd. & Butl.

Host: **Morinda citrifolia**. (Reynolds 1971: 1205).

27. musicola Bat. = **Limacinula musicola** (Bat.) Reyn.

Host: **Musa** sp. (Reynolds 1971: 1194).

28. penzigii (Sacc.) Yamam. = ?

Host: **Citrus** sp.

The mycelium of this species was described as "crustaceo, nigrescente, facile secedente", the ascomata as "peritheciis globulosis, superficialibus, e filis mycelibus oriundis sed glabris, ...", and the ascospores as "... 3-septato-muriformibus, constrictis, 11-12 = 4-5, hyalinis dein fuscidulis". It should be associated with "**Coniothecii, Heterobotrys, Chaetophomae, Capnodii** (spermogonici) species". All these data indicate that **P. penzigii** is not a **Phaeosaccardinula** species, but belongs in the Capnodiaceae.

29. pipericola Bat. & Vital

Host: **Piper nigrum**. (Bat. & Cif. 1962: 94).

The spores (Fig. 2C) are smaller than in **P. dictyospora** and usually seem to be divided by 7-8 A-transsepta as in this species, but by no or very few B-transsepta.

30. piperis Bat. & Peres

Host: **Piper nigrum**. (Bat. & Peres 1964: 159).

No information has been available to us about this species, but it does not affect the nomenclature of **P. dictyospora**.

31. pulcherrima (Höhn.) Petrak = **Treubomyces pulcherrimus** Höhn.

Host: **Ficus elastica** etc. (Reynolds 1983: 354).

32. seaveriana Toro = **Limacinula samoensis** Höhn.

Host: **Erythrina glauca**. (Reynolds 1983: 356).

33. tenuis (Earle) Seaver & Chardon = **Limacinula samoensis** Höhn.

Host: **Musa** sp., etc. (Reynolds 1971: 1197).

34. theae (Syd. & Butl.) Theiss. = **Limacinula theae** Syd. & Butl.

Host: **Camellia sinensis** (C. "thea"). (Reynolds 1971: 1205).

35. vera Bat. & Cif. = **Limacinula musicola** (Bat.) Reyn.

Host: **Psidium guajava**. (Reynolds 1971: 1194).

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摘 要

黑壳炭属 (*Phaeosaccardinula* P. Henn (1905:67)) 的特征是子囊果在叶面上表生、单腔、子囊壳状、无刚毛、被一层薄膜覆盖。壳心有囊状的双囊壁子囊。子囊内产生砖格状的、透明—略带褐色的子囊孢子。在此属名下曾有过三十多个种名, 其中许多属于其他属 (*Limacinula*, *Treubiomyces*; Reynolds 1971, 1983), 但是近代无人对这些种进行过研究。

曾从中国报道过黑壳炭属的两个种, 即爪哇黑壳炭 (*P. javanica*) 和长孢黑壳炭 (*P. longispora*)。两种均不属于此属。前一个种为 *Limacinula javanica* (Zimm.) Höhn., 后一个种为 *Treubiomyces roseosporus* (Höhn) Reyn. 然而在广西省发现的网孢刺盾炭 (*Chaetothyrium dictyosporum*) 是一个真正的黑壳炭。它不同于以前此属内所有的种。两个在巴西发现的种有相似的孢子, 但都比 *C. dictyosporum* 描述得晚, 并不影响此种的名称。我们建议此种为一新组合 *Phaeosaccardinula dictyospora* (Petr.) comb. nov.

本文研究了此种的超薄切片(材料包埋在塑料内)和一般制片, 修改了种的描述, 附有照片和绘图。文中将此种与属内其他种做了对比, 评论了此属内所有曾用过的种名。

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NEW SPECIES IN THE LICHEN GENUS XANTHOPARMELIA (VAIN.) HALE (ASCOMYCOTINA: PARMELIACEAE)

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Abstract.--Five new species of Xanthoparmelia are described: X. albomaculata from South Africa, X. alectoronica from Venezuela, X. austroamericana from Brazil, Argentina and Chile, X. keralensis from India and X. peruviansis from Peru. Alectoronic acid, colensoic acid and subcolensoic acid are reported for the first time in the genus.

Xanthoparmelia albomaculata Hale, sp. nov.

Fig. 1

Thallus saxicola, laxe adnatus, lobis sublinearibus, 3-5 mm latis, superne effigurato-maculatus, isidiis sorediisque nullis, subtus planus, niger, sparse rhizinatus; acidum sticticum continens.

Thallus adnate to loosely attached on rock, dull greenish yellow, 8-12 cm broad; lobes sublinear to subirregular, becoming imbricate, 3-5 mm wide; upper surface maculate to strongly effigurate-maculate, isidia and soredia lacking; lower surface plane, black, rhizines very sparse, black. Pycnidia numerous; conidia bifusiform, 1 X 5-6 μ m. Apothecia to 3.0 mm in diameter; spores 4-5 X 9-10 μ m.

Chemistry: Stictic, constictic and usnic acids.

Type: 6 mi N of Houtbosch, Distr. Pietersburg, Transvaal, South Africa, Almborn 6722, 12.10.1953 (LD, holotype; US, isotype).

This species belongs to the X. hypoleia group but is unique in several respects. It contains stictic acid, the only species here with this chemistry, has rather broad, finally subirregular lobes and is distinctly adnate on rocks. Typical X. hypoleia (Nyl.) Hale has linear, divaricate lobes and is loosely attached. Xanthoparmelia albomaculata is known only from the type collection.

Xanthoparmelia alectoronica Hale, sp. nov.

Figs. 2, 3

Thallus saxicola, arcte adnatus, centro areolatus, lobis sublinearibus, 0.3-0.8 mm latis, isidiatus, isidiis cylindricis, subtus planus, niger, modice rhizinatus; acidum alectoronicum continens.

Thallus very tightly adnate to subcrustose on rocks, greenish yellow at the margins but dark grayish green at the center, 2-3 cm broad; lobes sublinear, contiguous, 0.3-0.8 mm wide; upper surface continuous, isidiate, the isidia unbranched, black tipped, 0.03-0.05 X 0.1 mm; lower surface plane, black, moderately rhizinate, the rhizines black. Pycnidia and apothecia lacking.

Chemistry: Alecoronic and usnic acids.

Type: Loma de El León, Sierra Portuguesa, Estado Lara, Venezuela, M. López and R. Smith 21216A, 23 July 1979 (MERF, holotype; US, isotype).

Additional specimens examined. Venezuela: Same locality as the type, López and Smith 21176, 21188 (MERF, US).

Xanthoparmelia alecoronica is a member of the *X. mougeotina* group, which is characterized by the tightly adnate to subcrustose thallus, isidia and a black lower surface. *Xanthoparmelia mougeotina* itself contains stictic, constictic and norstictic acids, while other species contain hypoprotocetraric acid (*X. neocongensis* (Hale) Hale from East Africa), subcolensoic acid (*X. keralensis* described below) or salazinic acid (*X. diadeta* (Hale) Hale from Africa). This new species is unusual in containing alecoronic acid, the only occurrence of this depsidone in the genus (outside of the anomalous *X. centrifuga* group). It is known only from the type locality.

***Xanthoparmelia austroamericana* Hale, sp. nov.**

Fig. 4

Thallus terricola, laxe adnatus, lobis sublinearibus, 1–2.5 mm latis; superne continuus, isidiis sorediisque nullis, subtus planus, niger, sparse rhizinus; acidum sticticum continens.

Thallus loosely attached on soil or more rarely on rock, pale greenish yellow, 8–15 cm broad; lobes sublinear to subirregular, separate to imbricate, 1–2.5 mm wide; upper surface continuous, isidia and soredia lacking; lower surface plane, black, rhizines sparse, black. Pycnidia abundant; conidia bifusiform, 1 X 5–6 μ m. Apothecia to 5 mm in diameter. Spores 5 X 9 μ m.

Chemistry: Stictic, constictic, norstictic and usnic acids.

Type: Morro do Pinheiro Seco, Lajes, Santa Catarina, Brazil, Reitz and Klein 15724, 14.7.1963 (US, holotype).

Additional specimens examined. Brazil: Porto Alegre, Fleig 1760 (US). Argentina: Prov. Corrientes, Depto. San Martín, Krapovickas 29167 (CTES, US). Chile: Prov. Valparaíso, Santesson 2814, 3102 (S, US).

This austral species is externally close to *X. tasmanica* (Hook. & Tayl.) Hale but differs in chemistry (*X. tasmanica* has salazinic acid) and in having narrower, more contiguous lobes. *Xanthoparmelia hypopsila* (Müll. Arg.) Hale also contains stictic acid but is strictly saxicolous with adnate, subirregular lobes. Finally, a stictic acid-containing terricolous species from Australia, New Zealand and Madagascar, *X. suberadicata* (des Abb.) Hale, has very narrow (0.5–1 mm), subdivaricate lobes.

***Xanthoparmelia keralensis* Hale, sp. nov.**

Fig. 5

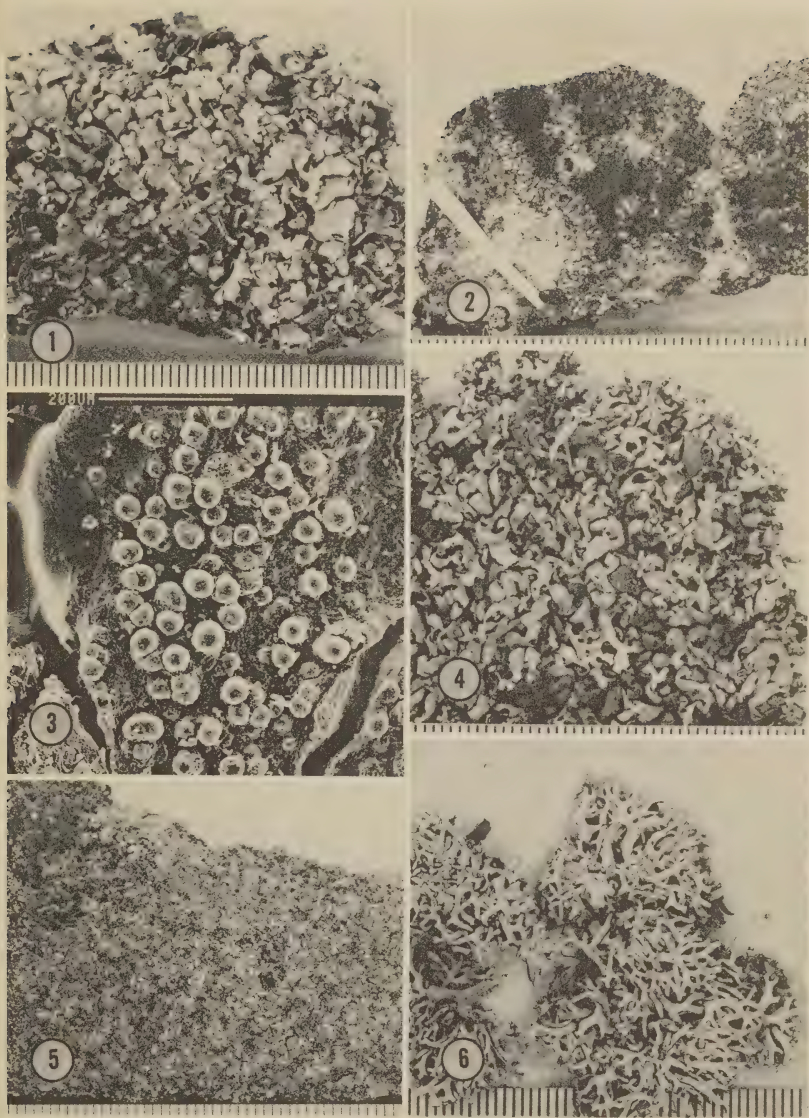
Thallus saxicola, arcte adnatus, lobis sublinearibus, contiguus, 0.2–0.5 mm latis, superne continuus, sparse isidiatus, isidiis cylindricis, subtus planus, niger, sparse rhizinus; acidum subcolensoicum continens.

Thallus tightly adnate on rocks, yellowish green, about 6 cm broad; lobes sublinear, short, contiguous, 0.2–0.5 mm wide; upper surface shiny, continuous, sparsely isidiate, the isidia 0.06–0.09 X 0.1 mm, black tipped; lower surface plane, black, sparsely rhizinate. Pycnidia and apothecia lacking.

Chemistry: Subcolensoic acid (major), colensoic acid ($\pm$ trace), norcolensoic acid ($\pm$ trace) and usnic acid (determined by Dr. J. A. Elix).

Type: 45 km from Munnar on the Munnar-Kodaikanal road, Kerala, India, elev. 1900 m, M. Hale 46480, 24 Jan. 1976 (US, holotype).

The main component of *X. keralensis*, subcolensoic acid, is unique in the genus. *Xanthoparmelia peruviana*, described below, contains colensoic acid



Figures 1-6. New species of *Xanthoparmelia*: 1, *X. albomaculata* (isotype in US); 2, *X. alectoronica* (isotype in US); 3, isidia of *X. alectoronica* with SEM; 4, *X. austroamericana* (holotype in US); 5, *X. keralensis* (holotype in US); 6, *X. peruviansis* (isotype in US). Scales in mm.

as the major component but is a totally unrelated species. Xanthoparmelia keralensis could at first be mistaken for X. mougeotina, although the lobes are shorter and the isidia very sparse. It has been found only at the type locality, a small outcropping of granite in a pastured area of Rhododendron forest.

Xanthoparmelia peruviansis Hale, sp. nov.

Fig. 6

Thallus terricola, laxe adnatus, lobis linearibus, separatis, 0.5-1.3 mm latis, superne leviter reticulato-maculatus, isidiis sorediisque nullis, subtus planus vel canaliculatus, brunneus, dense rhizinatus; acidum colensoicum continens.

Thallus loosely attached to free growing on soil, pale greenish yellow, 3-5 cm broad; lobes linear, dichotomously branched, separate, 0.5-1.3 mm wide, the ultimate lobes sometimes becoming terete; upper surface shiny, faintly reticulate-maculate, isidia and soredia lacking; lower surface plane to usually channeled with a pale yellow rim, the center brown to dark brown, rhizines dense, about 2 mm long, becoming furcate. Pycnidia not seen. Apothecia poorly developed, about 1 mm in diameter; spores absent.

Chemistry: Colensoic acid, lobaric acid and usnic acid (determined by J. A. Elix).

Type collection: Santa Rosa, Cuzco, Peru, elev. 13,500 feet, D. Wofford 532 (BM, holotype; US, isotype).

Additional specimen examined. Peru: Above Taucia, Prov. Urubamba, Depto. Cuzco, King et al. 221 (MIL, US).

Xanthoparmelia peruviansis is unusual in several respects. It contains colensoic acid, previously unknown in the genus (except as a minor component in the newly described X. keralensis above). It has dense, long rhizines and a reticulate-maculate surface. The lower surface may become rather strongly channeled with a pale rim, much as in the X. amphixantha group, which does not occur in the Americas. It is probably endemic to Peru at high elevations.

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PORE FUNGI FROM FRENCH ANTILLES AND GUIANA

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SUMMARY

Twentyfour species are recorded from the French Antilles and/or French Guiana from collections gathered in recent years by mycologists of Lyon University (France). Five species are proposed as new, namely, Flaviporus venustus sp. nov., Grammothelopsis incrustata sp. nov., Polyporus arcularioides sp. nov., Pyrofomes aurantiacus sp. nov. and Wrightoporia bruneo-ochracea sp. nov. The following new combinations are proposed: Phellinus rickii (Bres.), Amyloporus bracei (Murr.), Amyloporus iobaphus (Pat.), Funalia fulvocinerea (Murr.), Microporellus violaceo-cinereascens (Petch), Pyrofomes fulvo-umbrinus (Bres.) and Trametes maxima (Mont.) . Cystostiptoporus Dhanda & Ryv. is shown to be a nomenclatural synonym of Microporellus Murr. Ceriporia xylostromatoides (Berk.)Ryv. is a complex of species. Cultural studies were carried out with Flaviporus venustus sp. nov., Grammothele lineata Berk. & Curt., Hapalopilus albo-citrinus (Petch)Ryv., Microporellus dealbatus (Berk. & Curt.)Murr., Pachykytospora alabamiae (Berk. & Curt.) Ryv., Poria carneola Bres., Porogramme albo-cincta (Cke. & Massee)Lowe and Trametes membranacea (Sw.:Fr.)Kreisel. Nuclear behavior and sexual polarity are given for several species.

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2. Research undertaken during the tenure of a fellowship from the Consejo Nacional de Investigaciones Científicas y Técnicas de la República Argentina, in the Mycology Laboratory of Lyon University.

A large number of pore fungi have been collected in the French Antilles in the course of recent years by scientists of the Mycology Laboratory of Lyon University, notably A. David and J. Boidin; to these have been added those collected by P. Berthet in French Guiana. Our knowledge of the Polypores from these regions is due mainly to the work of Patouillard (1889, 1899, 1900 and 1902) and Duss (1903), and from several papers by L  veill   (1844 and 1846) and Montagne (1837, 1840, 1841, 1842, 1843, 1849 and 1854). Additional species remain to be encountered, according to their general distribution given in neotropical floras, e.g. Lowe (1958 and 1966), Murrill (1907-08 and 1915), Lloyd (1898-1925), Dennis (1970) and Ryvarden & Johansen (1980). The number and variety of our collections warranted their publication in order to contribute to a better knowledge of tropical polypores.

When possible spore prints were obtained in situ and many cultural, nuclear behavioral and sexuality studies were performed. Unfortunately a number of these cultures became contaminated during a long period of refrigeration and original data could not be reconfirmed. When possible collections were compared with types and collections from South America (Argentina) and Africa (personal collections in the herbaria of Drs. A. David and L. Ryvarden (Oslo University, Norway)).

METHODS

Genera and species are listed alphabetically. Poroid and grammotheoid Corticiaceae are included in the Polyporaceae.

Measurements and drawings were made from freehand sections mounted in a 1% phloxine solution and 5% KOH solution. Cultural studies followed Boidin's methodology (1958) and cultural characters were coded according to Nobles (1965) with the complements added by Boidin (1966) and Boidin & Lanquetin (1983). Color notations were made according to Munsell (1954). Herbaria abbreviations are from Holmgren & Keuken (1974), in addition LYAD refers to the herbarium of A. David which is at Lyon University. Type materials studied are indicated by a '!' following the herbarium abbreviation where it is deposited. Localities are cited with the following abbreviations: G= Guadeloupe, GI= French Guiana, M= Martinique. Unless otherwise indicated the collector is A. David.

RESULTS AND DISCUSSION

AGARICACEAE

Dictyopanus rhipidium (Berk.) Pat.

LYAD 1417 G, Basse Terre, path in the Sofaia region, 9.VIII.72;

LYAD 2135 G, Basse Terre, Corrosol river; LYAD 2268 G, Douville, 12.X.76

GANODERMATACEAE

Ganoderma lucidum (Leys.:Fr.) Karst. complex

LYAD 2230 M, Pointe Rouge forest, 7.X.76 .

Ganoderma australe (Fr.) Pat.

LYAD s.n. GI, Crique Grégoire, P. Berthet X.68, two collections;
LYAD 2227 M, Pointe Rouge forest, 7.X.76; LYAD s.n. M, family
Martinel IV.77 .

Humphreya coffeatum (Berk.) Stey.

LYAD 2233 M, forest of La Charles district, 9.X.76 .

HYMENOGASTRACEAE

Coltricia cf. spatulata (Hook.) Murr.

LYAD 1389 G, Deux Mamelles route, 3.VIII.72; LYAD 2173, ibid.,
30.IX.76; LYAD 2155 G, ibid., Petit Bourg towards INRA's laboratory
28.IX.76; LYAD 2237 M, forest of La Charles district, 9.X.76 .

Our collections differ from typical material because of
the absence of a distinct black line under the tomentum, but
they agree in all other macro and microscopic features.

Cyclomyces tabacinus (Mont.) Pat.

LYAD 1377 G, Natural Park, 31.VII.72; LYAD 1978 G, Tropical Park,
Piolet road, J. Boidin 12.VIII.72; LYAD 2122 G, Piolet's Youth
Village, 25.X.76; LYAD 2281 G, Douville region, 12.X.76 .

Inonotus rickii (Pat.) Reid

LYAD 2107 M, Fort de France, on Tamarindus indica, Jaquenoud 12.I.75.

Phellinus calcitratus (Berk. & Curt.) Ryv.

LYAD 2222 and 2223 M, Pointe Rouge forest, 7.X.76 .

Phellinus extensus (Lév.) Pat.

LYAD 2123 G, Deux Mamelles route, Piolet's Youth Village, 25.IX.76;
LYAD 2280 G, Grand David, X.76 .

Phellinus gilvus (Schw.) Pat. var. gilvus

LYAD 1366 G, path in the Deux Mamelles route, 30.VII.72; LYAD 1963
G, Deux Mamelles route, Ecrevisses cascade, J. Boidin 29.VII.75;
LYAD 2124 G, Piolet's Youth Village, 25.IX.76; LYAD 2177 G, Lézarde
forest, Forest Station, 30.IX.76; LYAD s.n. GI, P. Berthet X.68;
LYAD 260 M, Fort de France, at the river's margin between la Jos-
saud and le Marin, 7.I.65; LYAD 1363 M, Grand Riviere region,
28.VII.72; LYAD 2225 M, Pointe Rouge forest, 7.X.76; LYAD 2251 M,
Clark's Ravine, 10.X.76 .

Phellinus gilvus (Schw.) Pat. var. licnoides (Mont.) Lloyd in
Corner.

LYAD 2248 M, Clark's Ravine, 10.X.76 .

Phellinus nilgheriensis (Mont.) Cunn.

LYAD 2259 M, X.76 .

Phellinus portoricensis (Overh.) Fidalgo

LYAD 2247 and 2250 M, Clark's Ravine forest, 10.X.76 .

Phellinus punctatus (Fr.) Pilát

LYAD 1973 G, Petit Canal, J. Boidin 7.VIII.75; LYAD 2136 G, IX.76;
LYAD 2202 G, Grosse Montagne, X.76; LYAD 2231 M, Pointe Rouge fo-
rest, 7.X.76 .

These collections differ from typical European specimens
by forming thinner fruitbodies.

Phellinus rickii (Bres.) David & Rajchenberg comb. nov.

Basionym: Poria rickii Bres., Ann. Mycol. 18: 37, 1920
(BPI!).

LYAD 2137 G, Petit Bourg in front of INRA's laboratory, X.76 .

Our collection is identical with the type material at BPI. As stated by Setliff & Ryvarden (1983) the species comes close to Phellinus ferrugineo-velutinus (Henn.) Ryv. whose type, however, is sterile (Lowe, 1966; Ryvarden & Johansen, 1980) and then the name becomes of uncertain application. We reject Poria ferrugineo-velutina Henn. as a nomen ambiguum and propose the well represented Poria rickii Bres. as the name for this taxon. Phellinus glaucescens (Petch) Ryv. described from Africa and Asia is also identical in all respects. Study of more materials should probably show that it is an unique pantropical species.

Phellinus robustus (Karst.) Bourd. & Galz.

LYAD 2235 M, forest of La Charles district, 9.X.76 .

Phellinus roseo-cinereus (Murr.) Reid

LYAD 1981 G, Petit David, J. Boidin, 13.VIII.75; LYAD s.n. GI,
P. Berthet X.68; LYAD s.n. GI, Kourou, S. Lucas.

Phellinus undulatus (Murr.) Ryv.

= Fomitiporia undulata Murr. (NY!).

LYAD 2229 M, Pointe Rouge forest, 7.X.76 .

This species is characterized by hooked setae (fig. 1) which are unequally distributed in the hymenium. Spores vary from broadly ellipsoid, thin-walled and hyaline (as seen in the type) to broadly ellipsoid-subglobose, slightly thick-walled and pale yellow (in our collection, fig. 2). Our material is identical with the type collection in all other respects especially the kind of setae, pore sizes and hyphal features.

The pale-yellowish spores seen in our collection led us to Phellinus gilvoides (Petch) Ryv., an Asiatic species which has the same kind of spores. Lowe (1966) and Ryvarden & Johansen (1980) overlooked the presence of setae that are found in the cotype at Kew (n° 2884, Peradeniya, leg. Petch VII.1909, the only type material found at the herbarium). These setae are ventricose to subulate, 13-25 x 3,5-7 µm (fig. 3), and are only present in the dissepiments in the pore mouths and do not bend toward the hymenium into the pore. This collection probably represents an underdeveloped fungus.

Phylloporia frutica (Berk. & Curt.) Ryv.

LYAD 1387 G, Basse Terre, Deux Mamelles route, 2.VIII.72 .

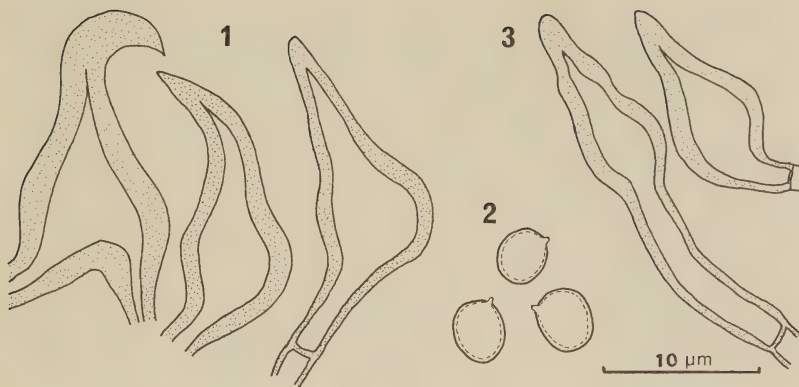
POLYPORACEAE

Amylosporus bracei (Murr.) David & Rajchenberg comb. nov.

Basionym: Poria bracei Murr., Mycologia 13: 91, 1921
(NY!).

= Amylosporus wrightii Rajch. (BAFC!).

LYAD 1328 M, Précheur region, Coulevre inlet, 21.VII.72; LYAD 2236 M, forest of La Charles district, 9.X.76 .



Figs. 1-2, *Phellinus undulatus*: 1. hooked setae; 2. spores. Fig. 3, *Poria gilvoides* (cotype): setae.

This species was recently described from subtropical forests in Argentine (Rajchenberg, 1983a). It is easily recognizable in the field by its widely effused fruitbody with a lilaceous pink pore surface (which may become yellowish cream upon drying). *Polyporus scleromyces* Berk. & Curt., stated by Lowe (1947, 1958 and 1966) to be a previous name for the species, does not seem to be the same taxon as it can be understood from its original description (cfr. P.A. Saccardo, Sylloge Fungorum 6: 183, 1888); otherwise it is stated to be sterile (Lowe, op. cit., Ryvarden, personal communication). *Polyporus vibratilis* Berk. & Curt. (K !) is also reported by Lowe to be a probable synonym of the species but spores in the type material are ellipsoid and have no reaction in Melzer, and generative hyphae are simple-clamped.

This species comes quite close to *Phaeolous iobaphus* Pat. (FH !) (Patouillard, 1922) which was described from Singapur and differs mainly by its darker vinaceous pore surface and its pore size 2-2,5 per mm (5-7 per mm in *A. bracei*). The hyphal system with simple-septate generative hyphae, wider multi-clamped (verticillate) generative hyphae (only found after careful examination in *P. iobaphus*) and dextrinoid skeletal hyphae, as well as the finely verruculose amyloid spores are similar in both species. The following new combination is proposed:

Amylosporus iobaphus (Pat.) David & Rajchenberg comb. nov.

Basionym: *Phaeolus iobaphus* Pat., Bull. Soc. Myc. France 38: 85, 1922 (FH !).

Amylosporus campbellii (Berk.) Ryv.

LYAD 1358 M, path between Coulevre and Grand Riviere, on the earth in a bamboo forest, 28.VII.72; LYAD 2217 M, Pointe Rouge forest, on a rotten wood buried in the ground, 7.X.76

According to Mr. J.P. Fiard, from Martinique, this polypore grows only in the meso and xerophytic forest during

August and September. Our two collections agree with the description given by Ryvarden & Johansen (1980); we supplement it with some observations taken from fresh material:

The pileus is glabrous to finely velutinate, more or less tuberculate, tending to become dirty white 5Y 9/2, chestnut grey 10YR 7/2 7/3 6/2 6/3 with presence of reddish chestnut spots 10R 4/4. The pore surface is white becoming greyish white with a light violaceous shine 7,5YR 8/2 5YR 8/2 with age; when bruised it stains red 5YR 5/8. The context is alutaceous yellow near 2,5Y 9/6 with numerous growing zones with either a hyaline aspect or with a more or less darkish chestnut colour. Tubes are concolorous with pore surface. Pores 4-6 per mm.

The two collections present the principal features of the species: amyloid finely warted spores, generative hyphae with simple septa and wider generative hyphae with also multi-clamped (verticillate) septa, and gloeopleurous hyphae; but they differ in some points: the context is not compressible and the dried fruitbody is neither light nor brittle.

Antrodia malicola (Berk. & Curt.) Donk

LYAD 1976 G, Basse Terre, Corrosol's ford, J. Boidin VII.75; LYAD 1332 M, Montravail forest, 23.VII.72; LYAD 2243 M, Clark's Ravine hygrophile forest, 10.X.72 .

Thirty monosporous cultures obtained from LYAD 1332 and twenty-one cultures from LYAD 2243 became all simple-clamped which certified the homothallism of the species (Sarkar, 1959). Nuclear behavior is normal.

Bjerkandera af. adusta (Fr.) Karst.

LYAD 1325 M, Couleuvre inlet, 20.VII.76; LYAD 2028 M, Lévrier inlet, M. Jaquenoud 21.III.76; LYAD 2218 M, Pointe Rouge forest, 7.X.76 .

Our collections differ from typical ones by being more massive. Carranza & Sáez (1984) also report large specimens from Costa Rica. They are all sterile thus we did not risk a definite determination. Nevertheless a spore print obtained from LYAD 1325 revealed spores with binucleate condition as found in B. adusta .

Ceriporia alachuana (Murr.) Hallenb.

LYAD 1329 M, Trinité, 22.VII.72; LYAD 2112 M, Jossaud, M. Jaquenoud 9.I.72 .

Giemsa coloration of fruitbodies LYAD 1329 and 2112 revealed that generative hyphae have slightly coenocytic articles with 1-5 nuclei and that spores are monokariotic.

Ceriporia xylostomatoides (Berk.) Ryv.

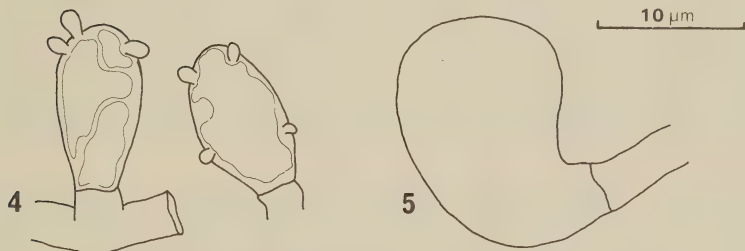
LYAD 1414 G, path in the Grande Savane region, on fallen log, 6.VIII.72; LYAD 1418 and 1419 G, Sofaia region, 9.VII.72; LYAD 2148 G, Jules' Forest road, 27.IX.76; LYAD 2238 M, forest of La Charles district, 9.IX.76; LYAD s.n. M, Lévrier inlet, M. Jaquenoud.

The collections from the French Antilles are all effused reflexed with narrow and crescent pilei 0,5-1 cm radius, elongated and forming a strip on the support; becoming thin in the margin. LYAD 1414 is totally formed by dimidiate fruitbodies 2-4 x 1,5-2 x 0,1-0,15 cm, with tubes 0,2-0,3 mm

long and context 0,1-1,2 mm wide. When fresh they are pure white, with gossypine consistency and become alutaceous upon drying. The abhymenial surface has 2-3 concentric furrows. Microscopic characters are identical with the descriptions given by Lowe (1966) and Ryvarden & Johansen (1980) but distinct hymenial cystidia have been seen in all the collections: they are thin-walled, claviform cystidia with several papillae, 10-11 x 5-6 μ m (similar to the size of basidioles) and stain strongly with cotton blue (fig. 4).

Cultural studies: our results from culture LYAD 1418 were similar to those presented by Nakasone & Gilbertson (1978). We add our oxidase reactions and citological results. The articles of the polysperm (LYAD 1418) and of the fruit-body (LYAD 2148) are binucleate and simple septate.

Oxidases: guaiacol 0,02%:++++, 0 p-cresol:-
guaiacol 0,2% :++++, 0 tyrosine:-
gallic ac.:++++



Figs. 4-5, *Ceriporia xylostromatoides*: 4. cystidia (French Antillean collections); 5. cystidium (Gabon collections).

REMARKS: Argentine pileate collections of *C. xylostromatoides* also had cystidia (BAFC 28774, Argentina, Misiones, Puerto Libertad, Alto Paraná plantation, M. Rajchenberg 24. XII.74 and BAFC 28526, *ibid.*, Gral. Belgrano, Forest Station leg. Wright, Deschamps and del Busto M-2466 29.X.73, on *Araucaria angustifolia*). Two African collections were studied: LYAD 2396, Gabon, la Mondah forest, G. Gilles 17.XII.77 and LYAD 2403, *ibid.*, 24.XII.77. They differ by being exclusively resupinate with no tendency to become reflexed and by the absence of papillate cystidia. Nevertheless they exhibited thin-walled, claviform, hymenial cystidia, larger than basidioles, 12-17 x 8-10 μ m with contents that stain intensely with cotton blue (fig. 5) and could possibly be considered gloecystidia. Many resupinate Argentine collections did not have any kind of cystidia and are identical to current descriptions of the species.

The studied material suggests that the name *C. xylostromatoides* is being applied to a complex of species that can be distinguished by the shape of the (resupinate, effuse-reflexed or only pileate) fruitbody, by the presence and kind of cystidia and by the geographic distribution.

Corioloopsis caperata (Berk.) Murr.

LYAD 1409 G, Sofaia region, 7.VIII.72; LYAD 2180, Lézarde forest, 30.IX.76; LYAD 2196 G, Grosse Montagne road, 4.X.76; LYAD s.n. GI, Crique Grégoire, P. Berthet X.68, 4 collections; LYAD 1341 M, Couleuvre inlet, in cacao plantation, 24.VII.72.

The species is tetrapolar and has a normal nuclear behavior (observation made on LYAD 1409).

Corioloopsis occidentalis (Klotz.) Murr.

LYAD 2132 G, Corrosol river, 23.IX.76; LYAD 1352 M, Grande Riviere region, 28.VII.72; LYAD 1360 M, Source Didier road, 27.VII.72.

For cultural studies see David (1970).

Favolus tessellatus Mont.

LYAD 1725 GI, Crique Grégoire, P. Berthet I.74; LYAD s.n. GI, ibid. X.68.

This species is distinctive with its small fruitbodies up to 2 x 2 cm, which are always petaloid or reniform with a short lateral stem, its woody consistency and its tessellate pileus due to the thin context (100-300 μ m thick). Pores are 1-1,3 per mm. Favolus bipindensis Henn., described from Cameroon, is quite similar and is probably a synonym; intercompatibility tests and cultural studies are needed to solve this problem.

Favolus brasiliensis (Fr.) Fr.

LYAD 2470 GI, leg. Fougèrousse.

A different plant from F. tessellatus. The fruitbodies are larger and pilei have an infundibuliform tendency which makes the lateral stem slightly eccentric; the context is thicker (300-550 μ m) and the abhymenial surface lacked a tessellate aspect, being striate and with a cartilaginous consistency. Pores are 0,6-1-(2) per mm.

Favolus sp.

LYAD 1378 G, Deux Mamelles route, 1.VIII.72; LYAD 2151 G, Petit Bourg, in front of the INRA's laboratory, 28.IX.76; LYAD 1402 M, Contrebandiers' path, Atlantic side, 5.VIII.72.

Fruitbody annual, dimidiate to flabelliform, frequently in groups, 3-6 cm long 2,5-3,5 cm radius and 0,6 cm wide (Fig. 7). Pileus slightly tessellate, pale chestnut when fresh, around 10YR 7/4 6/4 8/3 8/4, covered by a fine tomentum which is denser toward the stipe and by darker radial fibrils which are more distinct toward the margin. Stipe lateral and short, 3-4 mm long and 3-4 mm diam. concolorous with the pileus and finely tomentose, sometimes forming a white disc of mycelium on the support. Pore surface white. Pores 0,75 mm wide, radially elongated up to 2 mm long (Fig. 8).

Hyphal system dimitic with simple-clamped generative hyphae. Basidia claviform, 20-25 x 5-6 μ m, tetraspored. Spores cylindric, 8-10 x 3-3,5 μ m.

Sexuality tetrapolar and nuclear behavior normal (data obtained from LYAD 1378).

Fibuloporia donkii Dom.

LYAD 2185 G, Deux Mamelles route, 3.X.76; LYAD 2203 G, Grosse Montagne, 3.X.76; LYAD 2257 and 2285 G, Douville region, 7.X.76.



Figs. 6-7, Favolus sp.: 6. fruitbodies (x 1); 7. pore surface (x 1,5).

Collections from the French Antilles differ from typical ones in having smaller pores (6-8 per mm) and generative hyphae with relatively thicker walls (when compared with European materials).

Flaviporus brownei (Pers.) Donk

LYAD 1977 G, St. Claude, J. Boidin 11.VII.75; LYAD 1317 M, on an old fallen log in humid forest, 18.VII.72 .

Flaviporus liebmanii (Fr.) Ginns

LYAD 1371 and 1372 G, Basse Terre, Natural Park, 31.VII.72; LYAD 1386 G, Basse Terre, Deux Mamelles route, 2.VIII.72; LYAD 1961 G, Ecrevisses cascade, J. Boidin 29.VII.75; LYAD 1967 G, As de Pique road, J. Boidin 31.VII.75; LYAD 2232 G, Grosse Montagne forest road, 30.IX.76; LYAD 2268 G, Petit Bourg, facing the INRA's laboratory, X.77; LYAD 2278 G, Morne a Louis, X.77; LYAD 1319 M, 18.VII.72; LYAD 1345 and 1346 M, la Falaise gorge, 25.VII.72; LYAD 1355 M, path between Coulevre's inlet and Grand Riviere, 28.VII.72.

Flaviporus hydrophilus (Berk. & Curt.) Ginns

= Polyporus hydrophilus Berk. & Curt. (K !)

LYAD 1370 G, Basse Terre, Natural Park, 31.VII.72; LYAD 1379 G, Deux Mamelles route, 1.VIII.72 .

Both collections agree with the type material at Kew (Berkeley's herbarium, n° 353). An excellent description was given by Ginns (1980). Only color differences have been noted: according to Ginns this species is "...pale yellow to Ridgway's Clay Color (near Munsell 7.5YR 5/6)". Our collections were orange-cream 10YR 8/6 (LYAD 1370) and 10YR 6/8 7/8 (the latter being closer to the color given by Ginns).

Flaviporus subundatus (Murr.) Ginns

= Poria subundata Murr. (NY !)

LYAD 1971 G, Basse Terre, J. Boidin, VII.75; LYAD 2181 G, Lézarde forest house, 30.IX.76; LYAD 2187, Jules' forest road, 27.IX.76; LYAD 1336 M, between Morne Rouge and St. Pierre, 23.VII.72 .

The species was described by Lowe (1966) under Poria Pers. and by Ginns (1980).

Flaviporus Murr., as defined by the type species, has a dimitic hyphal system with regularly simple-clamped generative hyphae. In F. subundatus the dimitic hyphal system with simple-septate hyphae (verified after careful examination in the type material and our collections) and skeletal hyphae, the horny consistency, the salmon pink pore surface and the pseudoparenchymatous context point out to a better disposition of the species in Rigidoporus Murr. However the presence of thin-walled cystidia that emerge from the hymenium and stain strongly with cotton blue and the small, thin-walled, acyanophilous spores prevent such a transfer.

The description of Antrodiella straminea (Bres.) Ryv. & Johans., a species found in the Philippines and Africa, by Ryvarden & Johansen (1980), fits very well that of F. subundatus and a collection from Ryvarden's herbarium (Tanzania, Tanga, Usambara Mts., Amani, leg. Ryvarden n° 10719A, 18-19. II.73) is the same species. But our study of the type material of Poria straminea Bres.³ deposited at BPI (leg. Elmer n° 10162) showed that it has a di-trimitic hyphal system

with simple-clamped generative hyphae and spores are ellipsoid and truncate; its affinities are among Perenniporia Murr. species, as already pointed out by Bresadola (1912) when he related the species with Poria medulla-panis (Jacq.) Bres. var. pulchella Schw.

Flaviporus venustus David & Rajchenberg sp. nov.

Basidiocarpus annuus, magnus, dimidiatus, 15 x 6 x 4 cm, in vivo aquosus, hyalinus et fragilis, in sicco duro. Pileo albo sordido vel roseo pallido. Contexto translucido albo vel roseo pallido. Poris 6-10 per mm in sicco, roseo pallidis. Dissepimenti hyphis generativis fibulatis 2,5-4 µm valde agglutinatis. Contextus probabiliter monomiticus, cum hyphas generativas parietibus valde incrassatis, in substantia resinacea immersam et non discedens. Chlamydosporis clavatis in orem pororum adsunt. Basiditis claviformibus, tetrasporis, 8-12 x 4,5-5 µm. Basidiosporis subglobois, 3,5-4,3 x 2,5-3,2 µm acyanophilis. Holotypus LY-AD 2239 Martinique ad fauces Clark prope Absalon, in sylva hygrophyla ad truncis putrefactos, leg. A. David 10.X.1976.

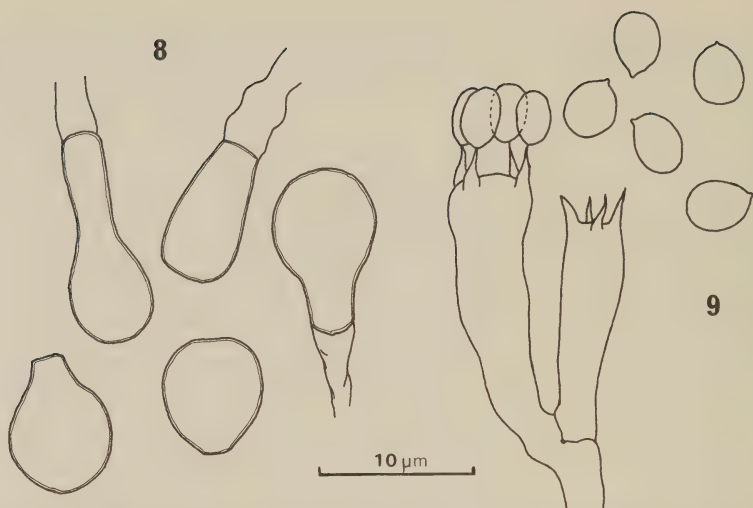
Fruitbody big, dimidiate, 15 cm long, 6 cm radius and 4 cm thick at the attachment point, watery, more or less hyaline and brittle. Pileus uniformly dirty white 10YR 9/2 to pale pink 5YR 9/2, smooth to slightly tuberculate. Context 5-6 mm thick when dried, translucent, whitish to pale pink when fresh, becoming chestnut and resinous horny when dried. Pore surface pale pink 5YR 9/3 to 8/4 when fresh. When dried pores 6-10 per mm and tubes up to 2 mm long. Above the tubes and in the context there may appear dark reddish lines in the dried fruitbody.

Hyphal system quite difficult to interpret: monomitic in the tubes with simple-clamped generative hyphae 2,5-4 µm diam, slightly thick-walled with a parallel disposition, very coherent and agglutinated and very difficult to dissociate. The context apparently monomitic but there are hyphae with very thick walls and even solid, not numerous, which are immersed in a resistant resinous umber matter and are impossible to dissociate. The resinous matter is not stainable, has a more or less laminar structure, and seems to originate from hyphae with a particular disposition whose walls become thickened at the extremities. Club-shaped chromophile vesicles are found in the dissepiments at the pore mouths (fig. 8). Basidia clavate, tetraspored, 15-20 x 4,5-5 µm. Spores subglobose, 3,5-4,3 x 2,5-3,2 µm, acyanophilous (fig. 9).

REMARKS: F. venustus is a very beautiful species, very easy to recognise in the field in the fresh condition, as its flesh is pink, quite pale, translucent and brittle. Alternatively it becomes unrecognisable when dried as it hardens very much and becomes horny, resembling a Flaviporus liebmanii (Fr.) Ginns but much thicker, and shrinks markedly, changing from 4 cm thick to 1 cm thick.

This taxon presents the features assigned to the species placed in the genus Flaviporus Murr.: a cartilaginous and brittle fruitbody in fresh condition, agglutinated hyphae and small, broadly ellipsoid to subglobose, acyanophilous spores. As in F. hydrophilus (Berk. & Curt.) Ginns and F. minutisporus (Reid, Thind & Chatrath) Ginns the hymenium lacks cystidia.

3. Not to be confused with Polyporus straminellus Bres., a true Polyporus species related to Polyporus virgatus Berk. & Curt. fide Bresadola (1920).



Figs. 8-9, *Flaviaporus venustus* (holotype): 8. vesicles present in the pore mouths; 9. basidia and spores.

Cultural studies

SPORES AND GERMINATION: spores are uninucleate and germinate in 1-2 days after shedding, giving rise to a simple septate mycelium with coenocytic articles.

SEXUALITY: bipolar, ten single spore cultures were distributed as:

A_1 : 1-2-8

A_2 : 3-4-5-6-7-9-10

POLYSPERM:

Growth: very rapid, dishes are covered in two weeks.

Aspect of the mat: aerial mycelium little developed, adherent to the agar and giving the impression of a peach peel. Around the dishes there is formation of more or less cartilaginous translucent shells which become light pink coloured with age and recall the fresh fruitbodies. Fructifications were obtained by leaving the dishes exposed to the light. Odor none. Reverse unchanged.

Microscopic features and cytology: the polysperm is irregularly simple-clamped and binucleate. Chlamydospores are found in the cultures and are generally binucleate but sometimes they contain 1, 3 or 4 nuclei. Some chlamydospores germinate giving rise to a simple-septate mycelium with highly coenocytic articles; the following are some assays of nuclei made from the terminal cell backwards:

625-9-4

581-3-6

448-46-38-4-3

When submerged in liquid media the polysperm loses its clamps and the articles become simple-septate and coenocytic.

Oxidases: guaiacol 0,02%: +++++, 6,5 cm

0,2 %: +++, 0 cm

gallic ac. : +++++

p-crésol: -

tyrosine: -

NUCLEAR BEHAVIOR: astatocoenocytic.

CODE: 2a. 3s. 7. 34. 36. 38. 42. 48. 54. 59. 65.

Fomes meliae (Underw.) Murr.

LYAD 1361 M, Source Didier road, 27.VII.72 .

Fomes fasciatus (Sw.:Fr.) Cke.

LYAD s.n. GI, P. Berthet X.68, two collections; LYAD s.n. GI, in the field with logs of St. Laurent de Marony on Vochysia sp. beam, S.Lucas; LYAD 2221 M, Pointe Rouge forest, 7.X.76 .

Fomitopsis supina (Sw.:Fr.) Ryv.

LYAD 1361 G, Source Didier region, 27.VII.72; LYAD 1367 G, Deux Mamelles route, 30.VII.72; LYAD 2140 G, Jules' forest road, 27.IX.76; LYAD 1714 GI, Crique Grégoire, P.Berthet 22.I.74 .

Funalia fulvocinerea (Murr.) David & Rajchenberg comb. nov.

Basionym: Coriolopsis fulvocinerea Murr., N. Amer. Fl. 9: 76, 1908 .

LYAD 2193 G, St. Anne region, in a pole in a plantation, 3.X.76; LYAD 671 G, on calcinated wood, J.Berthet X.68; LYAD 2463 GI, Cayenne region, on a fence pillar, M. Fougerousse III.82 .

This species was included in Coriolopsis by Murrill and was described by Fidalgo & Fidalgo (1967). It was excluded from the genus by David (1970) who showed that it had binucleate spores and a heterocytic nuclear behavior, features found in Funalia trogii (Berk.) Bond. & Sing. and Trametes hispida Bagl. (David, 1967), and characteristic of Funalia Pat. Trametella Pinto Lopes, where it was previously placed is a nomenclatural synonym of Funalia Pat.

Coriolopsis floccosa (Jungh.) Ryv., a species described from East Africa and recorded as pantropical (Ryvarden & Johansen, 1980) presents a similar greyish tint of the pore surface and spores. It would be very interesting to know the number of nuclei in the spores of this species. In any case cytological and interfertility tests are necessary to verify the limits of both taxa.

Gloeophyllum striatum (Sw.:Fr.) Murr.

LYAD 2274 G, Bouillante region, on a beam of an old house, 9.X.76; LYAD 672 GI, Cayenne region, P.Berthet X.68; LYAD 2462 GI, St. Laurent, M.Fougerousse I.82; LYAD 1331 M, Caravelle peninsula, 22.VII.72.

David (1970) undertook the cultural and cytological studies of this species which, as in other taxa of the genus (David, 1968), she demonstrated to have astatocoenocytic nuclear behavior, binucleate spores and bipolar sexuality. It also produces a brown rot in the substrate.

Gloeoporus thelephoroides (Hook.) Cunn.

LYAD 1722 GI, Saül environments, P.Berthet I.74; LYAD 2234 M, forest of La Charles district.

David (1972 a) studied the cultural and cytological characters of this species under the name Gloeoporus conchoides Mont.

Grammothele fuligo (Berk. & Br.) Ryv.

LYAD 2205 G, Basse Terre, Mamelles Pigeon road, on Arecaceae, J.Boidin; LYAD s.n. GI, P.Berthet X.68 .

Grammothele lineata Berk. & Curt.

LYAD 2198 G, Grosse Montagne road, Petit Bourq side, 4.X.76; LYAD 2207 G, Morne Leger, 6.X.76 .

Cultural studies

SPORES AND GERMINATION: spores are uninucleate and germinate in 3-4 days after shedding, producing primary mycelia with simple septate uninucleate articles.

SEXUALITY: tetrapolar, ten single spore cultures were distributed as:

A_1B_1 : 1-5

A_2B_2 : 2-8-9

A_1B_2 : 7-10

A_2B_1 : 3-4-6

POLYSPERM:

Growth: Petri dishes are covered in 2 wk.

Aspect of the mat: margin regular and appressed. Aerial mycelium white, radially striate, denser and gossypine, growing over the edge of the Petri dish. From the 2nd wk onwards there appear distinct narrow lines of mycelium that form crusts which become circular strips 0,5-1 cm wide, of felty sulcate and detachable mycelium, beige pink 7,5YR 8/6 8/7 8/4, beige ochraceous and/or light chestnut 5YR 6/6 (fig. 10). Odor: none. Reverse unchanged.

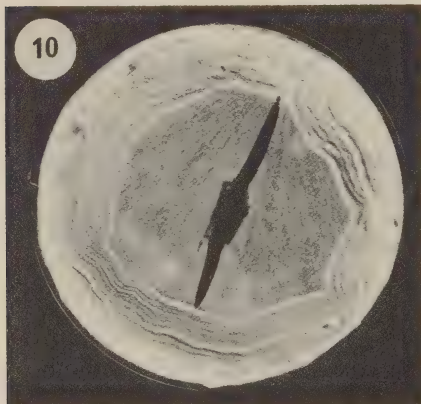


Fig. 10,
Grammothele lineata (LYAD 2198):
aspect of the mat (x 0,6).

Microscopic characters: marginal zone with generative hyphae 4 μ m diam., with first clamps at 180-300 μ m from hyphal tips, and narrower ramifications. Aerial mycelium with regularly simple-clamped, thin walled hyphae 2-3 μ m diam. with very narrow ramifications, in most cases aseptate, that form an undissociable intricate net. Forming numerous octahedric crystals condensed in 'baguettes' 100-150 x 10 μ m. Crusts are formed of a plectenchyma composed of sclerified generative hyphae, many times coralloid, tightly intertwined and embedded in an amorphous, coloured substance. Some fibers are also found in the crusts.

Cytology: hyphae are formed by binucleate articles.

Oxidases: guaiacol 0,02%: +++++, 3,5 cm

p-crésol: -

0,2 %: +++, 3,5 cm

tyrosine: -

gallic ac.: +++++

NUCLEAR BEHAVIOR: normal.

CODE: 2a. 3c. 8. 11. 32. 36. 42. 54. 60. 61.

Grammothele subargentea (Speg.) Rajch.= Poria subargentea Speg. (LPS !).

LYAD 2167 G, la Lézarde forest, Fougères Forest House, on bamboo, 30.IX.76; LYAD 2182 G, la Lézarde forest, 30.IX.76; LYAD 2197 and 2199 G, Grosse Montagne, Deux Mamelles route, 4.X.76; LYAD 2210 G, Deux Mamelles route, Morne Leger, 6.IX.76; LYAD s.n. M, Fort de France.

Rajchenberg (1983 b) described the cultural characters of this species. Thus we present only polarity and nuclear behavior data.

SPORES AND GERMINATION: spores are uninucleate and germinate in 1-2 days after shedding, forming mycelia with uninucleate simple-septate articles.

SEXUALITY: tetrapolar (observation made from LYAD 2182):

A_1B_1 : 1-6-9	A_2B_2 : 7-10
A_1B_2 : 2-8	A_2B_1 : 3-4-8

POLYSPERM: cultures LYAD 2182 and LYAD 2197 developed identical macro and microscopic features as described previously from Argentine cultures (BAFC 2476 and BAFC 542, Rajchenberg, op. cit.).

Cytology: articles of polyspermic mycelium are binucleate.

Oxidases: guaiacol 0,02%: +++++, 6 cm	p-crésol: -
0,2 %: ++++	tyrosine: -
gallic ac.: +++++	

NUCLEAR BEHAVIOR: normal.

CODE: 2a. 3c. 8. 11. (21). 35. 36. 37. 39. 40. 42. 50. 54. 60. 61.

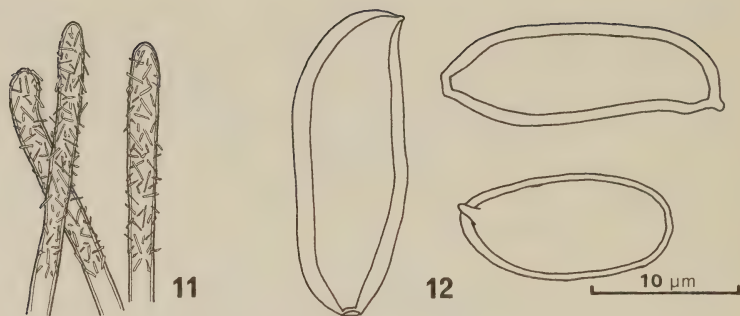
REMARKS: Buller tests between monosperms from the Argentine BAFC 2476²⁻⁵⁻⁶⁻¹⁰ cultures and the polysperm from the French Antilles LYAD 2182 were positive.

Grammothelopsis incrustata David & Rajchenberg sp. nov.

Basidiocarpio annuo, resupinato, circulari, corneo, in vivo luteo canarino, margini sterili gossypino. Poris circularibus 3-4 per mm. Contexto et tubis brevibus atro luteis. Oribus porum et margo cum pruina luteo albida obtectus. Systema hypharum dimiticum. Hyphis generativis fibulatis 2-3 μ m diam. Hyphis skeletibus ramosissimis 2-3,5 μ m diam., parietibus incrassatis cyanophilis. Pruina facta hyphis generativis cum parietibus incrassatis crystallia bacilliformes obtectus. Basidia non visu. Basidiolis claviformes 20-30 x 9-15 μ m. Basidiosporis copiosis, cylindraceo-ellipsoideis, truncatis 16-22 x 6-8 μ m, parietibus incrassatis 0,5-1,5 μ m, cyanophilis, indextrinoideis, apiculatis cum poro germinalis perspicuo. Putrefactione ligno alba. Holotypus LY-AD 2204 Guadeloupe, Grosse Montagne, via sylvatica, leg. A. David 4.IX.1976

Fruitbody annual, resupinate, forming circular plates with irregular outline, 1-4 cm diam., and a gossypine, sterile margin. Pores circular, 3-4 per mm. Pore surface duckling yellow 5Y 9/6 9/8 when fresh. Context very thin (40 μ m) and tubes short (0,4-0,75 mm) with a horny trama, more or less dark yellow 7,5YR 7/8. Pore mouths and margin covered with a white yellowish pruina.

Hyphal system dimitic. Generative hyphae regularly simple-clamped 2-3 μ m diam. and thin walled; skeletal hyphae sinuose, much branched, 2-3,5 μ m diam. with thickened and strongly cyanophilous walls. Pruina and margin formed of generative hyphae with slightly thickened walls and



Figs. 11-12, *Grammothelopsis incrustata* (holotype): 11. incrustate generative hyphae present in the pore mouths and margin of the fruitbody; 12. spores.

covered with numerous bacillar crystals (fig. 11).

Basidia not seen. Basidioles claviform, 20-30 x 9-15 µm, with abundant oily contents. Spores very abundant, cylindric-ellipsoid and truncate, 16-22 x 6-8 µm, with thickened walls 0,5-1,5 µm, strongly cyanophilous, IKI -, with a distinct apiculus and a germ pore (more or less distinct according to spore maturity) responsible for the truncate shape (fig. 12).

Holotype: LYAD 2204 Guadeloupe, Grosse Montagne, Forest road, leg. A. David 4.IX.76. Associate with a white rot.

REMARKS: the only material studied differs from *Grammothelopsis macrospora* Ryv.(Jül.) (= *Grammothele macrospora* Ryv. 0 !) by: a- the circular pores, b- the non-dextrinoid and narrower spores (7,5-11 µm in *G. macrospora*) and c- the presence of strongly incrustate hyphae in the pore mouths instead of dendrohyphidia.

AFFINITIES: spores of *G. incrustata* present distinctive characters such as the large size, the thick and strongly cyanophilous walls and a germ pore opposite the apiculus. All these characters suggest an affinity of *Grammothelopsis* Jül. with the genera *Perenniporia* Murr., *Pyrofomes* Kotl. & Pouz. and *Loweporus* Wright, already suggested by Jülich (1981) who assembled all these genera in the family *Perenniporiaceae* Jül.

Hapalopilus albo-citrinus (Petch)Ryv.

=*Poria albo-citrina* Petch (K !)

=*Poria rhoadsii* Murr. (NY !)

LYAD 1383 G, Deux Mamelles route, 2.VIII.72 ; LYAD 1320 M, 18.VII.72

Fruitbody resupinate with the margin narrow and fimbriate or absent. Pore surface gold yellowish 2,5Y 8/10 8/8, becoming strawberry red with KOH solution. Pores 4-5 per mm; tubes concolorous, up to 1 mm long. Context paler, more or less translucent with yellowish zonation.

Hyphal system monomitic with simple-clamped generative hyphae 3-5 µm diam., with thin to thickened walls up to 1-1,5 µm thick, compactly arranged in the trama, some of them covered here and there with conspicuous yellowish resinous matter and end in swollen extremities 4-8 µm

diam. where the resinous matter is thickly deposited and confers on them a chestnut-yellowish colour (fig. 13). This matter dissolves in KOH solution.

REMARKS: our collections match very well the type material of the species as well as the description given by Ryvarden & Johansen (1980). Lowe (1966) overlooked the presence of the incrusted swollen hyphae when describing Poria rhoadsii Murr. but they were found in the type material as well as in a collection from Lowe's herbarium (n° 4302, U.S.A., Florida, Gainesville, on pine log, leg. & det. J.L. Lowe 11.VIII.50).

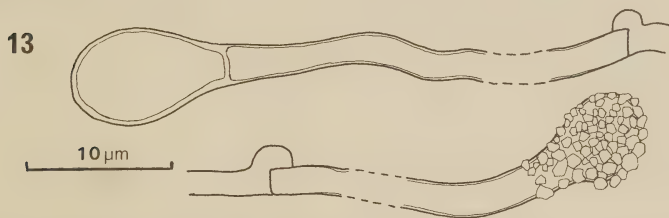


Fig. 13, Hapalopilus albo-citrinus: swollen extremities of generative hyphae.

Cultural studies (from LYAD 1383)

MONOSPERM: unfortunately we have no monosporous cultures but the polysperm loses its clamps when submerged in liquid media (anaerobic conditions) and is then formed of hyphae with coenocytic articles. This behavior is distinctive of the astatocoenocytic species. Their submerged polysperm cultures have the same cytology as their monosporous cultures. It is probable that monosporic cultures of H. albo-citrinus have hyphae with coenocytic articles.

POLYSPERM:

Growth: very slow, dishes covered in 6-7 wk.

Aspect of the mat: margin submerged and dendroid. Aerial mycelium poorly developed, appressed, at first white felty, becoming denser, finely granular, and gold yellow 2,5Y 8/10 8/12 turning to strawberry red with ammoniacal vapors.

Microscopy: submerged margin formed by simple-septate generative hyphae 2-3 μm diam. Aerial mycelium formed by regularly simple-clamped generative hyphae frequently covered with a gold yellowish seemingly amorphous matter. Some 30-50 μm long branches present swollen extremities covered with crystals; these elements correspond to those found in the fruitbodies.

Cytology: the polyspermic mycelium has a majority of binucleate simple-clamped articles and other irregularly clamped articles with 1-2 nuclei. The submerged mycelium loses its clamps and the articles become coenocytic. The following are some assays of nuclei made from the terminal cell backwards: 83-10-4-5-2-3-6-3-2

60-8-2-4-2-2-4

Frequently the polysperm grows poorly under collodion and then it is composed by hyphae with short articles containing 1-4 nuclei.

Oxidases: guaiacol: 0,02%: ++

p-crésol: -

0,2 %: +

tyrosine: +, 0

gallic ac.: ++++

NUCLEAR BEHAVIOR: seemingly astatocoenocytic.

CODE: 2. 3s. 4. 7. 32. 36. 37. 38. 46. 47. 54. 65.

REMARKS: H. albo-citrinus has then the same nuclear behavior as other temperate species of Hapalopilus Karst.: H. nidulans (Fr.)Karst. and H. croceus (Fr.)Donk (David, 1969).

Hexagonia hydroides (Sw.:Fr.)Fidalgo

LYAD 1972 G, Petit Canal, on Casuarina, 7.VIII.75; LYAD 2128 G, Pointe de la Vigie, on dead Casuarina, 26.IX.76; LYAD s.n. GI, Kourou, leg. CTFT B-148; LYAD s.n. GI, Lassore Park, leg. CTFT B-184; LYAD s.n. GI, Cayenne, P.Berthet X.68; LYAD 1340 M, Trinité, 24.VII.72 .

See David (1970) for cultural and cytological studies.

Hymenogramme lateritia Pat.

LYAD 2189 G, Basse Terre, 4.X.76 .

Laetiporus sulphureus (Büll.:Fr.)Murr.

LYAD 1382 G, Deux Mamelles route, 2.VIII.72 .

Lenzites elegans (Spreng.:Fr.)Pat.

LYAD 1365 and 1368 G, Deux Mamelles route, 30.VII.72; LYAD 1413 G, Grande Savane region, 6.VIII.72; LYAD 667 GI, Cayenne environs, P. Berthet 12.X.68.

For cultural and cytological studies see David (1970).

Loweporus roseo-albus (Jungh.)Ryv.

LYAD 1407 G, Basse Terre, Sofaia region, 7.VIII.72 .

Loweporus tephroporus (Mont.)Ryv.

LYAD 2482 GI, on open-air woodwork, S.Lucas 1975 .

The species is tetrapolar and has a normal nuclear behavior. Intercompatibility tests performed between the monosporic cultures from the French Antilles LYAD 2482₁₋₂ and the Argentine ones of BAFC 41₄₋₇₋₉₋₁₀ (Argentine, Salta, Campo Durán, leg. Wright, DesChamps & del Busto S-2660 11. XI.74) were positive and interfertile (with production of fruitbodies in culture). Bullerizations performed between LYAD 1915 (n+n) from Congo (Fuola Kari) and the Argentine monospermes BAFC 41₃₋₅₋₆₋₈ were also positive with fruitbodies forming in the confrontations with the monosperms 3 and 8 .

Microporellus dealbatus (Berk. & Curt.)Murr.

=Polyporus dealbatus Berk. & Curt. (K !)

LYAD 1410 G, Vernou region, behind INRA's laboratory, 7.VIII.72;

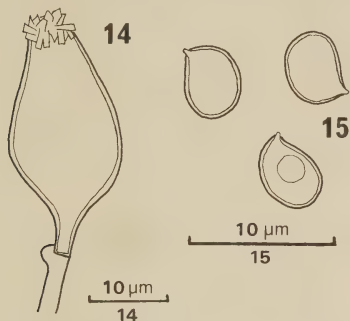
LYAD 2176 G, Lézarde forest, Fougères House, 30.IX.76 .

We refer to Murrill (1907) and Overholts (1953, Pl. 54 fig. 326) for macromorphological descriptions. These authors give different pore sizes for this species: Murrill, 8-10 per mm and Overholts 6-7 per mm. Our collections agree with the size given by the former: 10-12 per mm. The micromorphological data below supplements earlier author's descriptions:

Hyphal system dimitic. Generative hyphae regularly simple-clamped, 2-4 µm diam.; skeletal hyphae straight, not branched, 3-7 µm diam. in

the context, 2-5 μm diam. in the dissepiments, generally with a distinct lumen, walls up to 2 μm wide, strongly dextrinoid and cyanophilous.

Basidia claviform and tetraspored, 15 x 6-8 μm . Cystidia ventricose, subhyaline with walls up to 1 μm thick wide especially in the apex where they are generally incrustated, more abundant near the pore mouths, 20-30 x 15-19 μm (fig. 14). Spores broadly ellipsoid, hyaline, 4,5-5,5 x 3-4-(4,5) μm , with slightly thickened walls, strongly cyanophilous and weakly dextrinoid (fig. 15).



Figs. 14-15,
Microporellus dealbatus:
14. cystidium; 15. spores .

REMARKS: macro and micromorphological features have been verified in the type collection of Polyporus dealbatus Berk. & Curt. at Kew (n° 836). The presence of dextrinoid skeletal hyphae and incrustated cystidia were not previously reported in M. dealbatus and make of them a unique and particular set of characters among Polypores. This set was used to erect the genus Cystostiptoporus by Dhanda & Ryvarden (1975) with C. indica Dhanda & Ryv. as type species (a nomenclatural synonym of C. violaceo-cinerascens (Petch) Ryv., see Ryvarden & Johansen, 1980), but it must fall into synonymy of Microporellus Murr. because of priority. The latter must contain both species and we propose the new combination: Microporellus violaceo-cinerascens (Petch) David & Rajchenberg comb. nov.; basionym: Polyporus violaceo-cinerascens Petch, Ann. Roy. Bot. Gard. Peradeniya 6:41, 1916.

Cultural studies: (performed with LYAD 1181, U.S.A., Louisiana, St. Tammany, Talisheek, on the ground, leg. & det. A. Welden 13.VIII.71).

SPORES AND GERMINATION: spores are uninucleate and germinate in 6-7 days after shedding, giving rise to simple septate hyphae with uninucleate articles.

SEXUALITY: tetrapolar

A_1B_1 : 3-6-8

A_2B_2 : 1-4-5-10

A_1B_2 : 2-7

A_2B_1 : 9

POLYSPERM:

Growth: rapid, covering the Petri dish in 3 weeks.

Aspect of the mat: margin regular. Mycelium downy, becoming cottony felty with age, at first pure white becoming white to violaceous grey at the margin of the dish 5YR 8/2 8/3; forming a soft elastic pellicle that may be detached from the medium; more woolly in the centre of the dish. Odor none. Reverse unchanged.

Microscopy: margin formed with regularly simple-clamped generative hyphae. Aerial mycelium formed with simple-clamped generative

hyphae 2-3 μm diam. and a great number of fiber hyphae 1-1,5 μm diam. that give rise to extremely thin branches that form a net. These fibers are slightly dextrinoid and strongly cyanophilous.

Cytology: hyphae are formed by binucleate articles.

Oxidases: guaiacol 0,02%: +++++, 3 cm	p-crésol: -
0,2 %: +++, 0	tyrosine: -, 2 cm
gallic ac.: +++++, 0	

NUCLEAR BEHAVIOR: normal.

CODE: 2a. 3c. 8. 32. 36. 38. 43. 56. 60. 61.

Microporellus obovatus (Jungh.) Ryv.

LYAD 1384 and 1385 G, Basse Terre, Deux Mamelles route, 2.VIII.72; LYAD 1405 G, Basse Terre, Natural Park, path in the Quiock river, 6.VIII.72; LYAD 1974 G, Basse Terre, Corrosol's ford, J.Boidin 8.VI.75; LYAD 2119 G, Basse Terre, Corrosol River, 24.IX.76; LYAD 2266 G, Grand Etang, St. Sauveur region, 10.X.76; LYAD s.n. GI, P. Berthet X.68, three collections.

REMARKS: for the above cited reasons the macro and micromorphological features of this species (see Ryvarden & Johansen, 1980) do not match with the definition of the genus Microporellus Murr. and the species should be excluded from the genus. Nevertheless its place among other genera of Polyporaceae is uncertain. The creation of a new genus should be preceded by a careful study of other species included by Murrill in Microporellus. Thus we prefer to provisionally employ the binomial M. obovatus.

Microporellus af. violaceo-cinerascens (Petch) David & Rajch.

LYAD 1721 GI, Mahury, P. Berthet 17.I.74.

This collection differs from the holotype (Polyporus violaceo-cinerascens Petch, n° 2678, Peradeniya X.1908, at K!) and from the description of the species given by Ryvarden & Johansen (1980) by the following characters: a) The material from the French Guiana has a thinner and more flexible pileus and the abhymenial surface is covered and over-run by dark greyish fibrills (as seen in the photograph of the collection named as Polyporus dealbatus Berk. & Curt. in Overholts - 1953, Pl. 51 fig. 306, compare also with Pl. 54 fig. 326 with more typical collections of that species-), b) Spores in the French Guiana collection are 6-7 x 5-5,5 μm and Ryvarden & Johansen give larger sizes, 8-10 x 5,5-7 μm (but 7-8,5 x 5-6 μm according to our observations in the type material).

Microporellus dealbatus and M. violaceo-cinerascens are allied species similar in external aspect but differ in: a) Size of pores, which are 8-10-(12) per mm in the former and 2-3 per mm in the latter; b) Spores are larger and have a stronger dextrinoid reaction in the second; c) Geographical distribution is so far known restricted to temperate and tropical America for M. dealbatus and East Asia (India and Sri Lanka) for M. violaceo-cinerascens. The study of the French Guiana collection (and another from Singapour, LYAD 1767) suggests the probable existence of a third taxon near to M. violaceo-cinerascens that differs by the coloration and consistency of the pileus and the pore size (intermedi-

ate between the latter and M. dealbatus). Only interfertility tests and the study of more collections can determine the range, limits and affinities of all the taxa.

Navisporus sulcatus (Lloyd)Ryv.

LYAD 1404 G, path in the Quiock river, Natural Park, 6.VIII.72 .

Our collection is similar to the photograph published by Lloyd (1922) and the description given by Ryvarden (1983). Only the pores are slightly different, being 5 per mm in our collection and 2-3 per mm in Ryvarden's description. Spores (fig. 16) and skeletal hyphae are slightly cyanophilous.

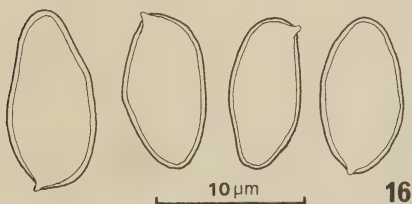


Fig. 16, Navisporus sulcatus: spores.

Nigroporus vinosus (Berk.)Murr.

LYAD 1376 G, Basse Terre, Natural Park, 31.VII.72; LYAD 2201 G, Deux Mamelles route, 4.IX.76; LYAD 2277 G, Clark's Ravine forest, 10.X.76; LYAD 1333 M, La Trace, 22.VII.72 .

The species is tetrapolar and has a normal nuclear behavior (observations made from LYAD 1333 and 2277, which were also intercompatible). Intercompatibility tests between the monosporic cultures LYAD 1333₁₋₂ and 2277_{I-III} with the Argentine ones BAFC 588_{I-II-III-IV} (Argentine, Corrientes, Mburucuyá, Sta. Teresa ranch, leg. Wright, Deschamps and del Busto C-1913 16.VIII.72) were all positive.

Oxyporus latemarginatus (Dur. & Mont.)Donk

LYAD 2178 G, Traversée des Mamelles, 30.IX.76 .

The material studied has similar microscopic features shown by typical European collections but is macroscopically not as massive with tubes only up to 0,5 mm long.

Pachykytospora alabamae (Berk. & Cke.)Ryv.

LYAD 2186 G, Deux Mamelles route, 3.X.76; LYAD s.n. GI, P.Berthet X.68 .

Cultures of this species had never been studied; the isolate from LYAD 2186 fructified in the laboratory.

SPORES AND GERMINATION: spores are uninucleate and germinate in 12-15 days after shedding, giving rise to simple septate hyphae with uninucleate articles.

SEXUALITY: tetrapolar,

A₁B₁: 1-6-8-12-14-16-17

A₂B₂: 2-3-4

A₁B₂: 5-7-10-11- 13-15-18-20

A₂B₁: 19

POLYSPERM:

Growth: very slow, covering 5-6 cm of the Petri dish in six weeks.

Aspect of the mat: margin submerged, irregular and broadly lobate. Aerial mycelium at first little developed, and the agar can be seen

by transparence; later becoming powdery around the inoculum and clotted cottony in the rest of the colony (fig. 17). There is formation of fructifications from the 2nd week on, principally around the inoculum.

Microscopy: margin formed with regularly simple-clamped generative hyphae 3 μm diam. which rapidly give rise to extremely thin, branched and aseptate hyphae 0,5 μm diam. with cyanophilous walls, that form a characteristic net as found in cultures of species of Perenniporia Murr. The same kind of hyphae are found in the aerial mycelium.

Cytology: hyphae are formed by binucleate articles.

Oxidases: guaiacol 0,02%: +++

p-crésol: -, 0

0,2 %: ++++

tyrosine: -, 0

gallic ac.: ++++

NUCLEAR BEHAVIOR: normal.

CODE: 2a. 3c. 8. 32. 36. 38. 47. 60. 61.



Fig. 17,
Pachykytospora alabamae
(LYAD 2186): aspect of the
mat (x 0,6).

REMARKS: it is interesting to point out that this tropical species behaves as the European P. tuberculosa (D.C.:Fr.) Kotl. & Pouz., which also exhibits a very slow growth, a normal nuclear behavior and tetrapolar sexuality as shown by David (1972 b).

Perenniporia albidia Rajchenberg & Wright (BAFC !)

LYAD 2153 G, Petit Bourg, towards INRA's laboratory, 28.IX.76; LYAD 2234 M, St. Esprit, 9.X.76 .

This species was recently described from subtropical forests in Argentine (Rajchenberg & Wright, 1982).

Polyporus arcularioides David & Rajchenberg sp. nov.

Basidiocarpus annuus, infundibuliformis, stipite crasso centralis. Pileus 3-7 cm diam. leviter pubescens, castaneus, margine incurvato. Poris 2-2,5 per mm longe decurrentibus. Systema hypharum dimiticum. Hyphis generativis fibulatis et hyphis skeletibus ramosissimis. Basidiis claviformibus, tetrasporis, 20-25 x 5 μm . Basidiosporis cylindraceis 6-7-(8,5) x 2,5-3,5 μm . A Polyporus arcularius Batsch:Fr. valde affine sed differt agendi nucleatus normalis. Holotypus LY-AD 1323 Martinique regio Precheur, leg. A. David 19.VII.1974 .

Fruitbody annual, centrally stipitate, infundibuliform. Pileus 3-7 cm diam., slightly downy when seen with the lens, pale to yellowish chesnut 10YR 7/4 7/6; margin becoming acute, entire or lobed, generally incurved (Fig. 17). Pores 2-2,5 per mm, radially elongated and decurrent on the stipe. Stipe stout, 2-3 cm long and 0,3-0,5 cm diam., narrowing from top to bottom. Context thinner than tubes, 0,3-0,5 mm thick; tubes 1-1,3 mm long.

Hyphal system dimitic with simple clamped generative hyphae and branched skeletal. Basidia claviform and tetraspored, 20-25 x 5 μ m. Spores cylindric, hyaline, 6-7-(8,5) x 2,5-3,5 μ m.

Material studied: LYAD 1323 M, Pr  cheur region, 19.VII.74 (Holotype); LYAD 1349 M, Grand Riviere region, 26.VII.72; LYAD 1400 M, Contrebandiers' path, Atlantic side, 5.VIII.72 .

REMARKS: this species reminds in a general way Polyporus arcularius Batsch:Fr. but the tubes are a lot more decurrent on the stipe and the stipe is stouter. P. arcularius also exhibits a heterocytic nuclear behavior, germinating spores have coenocytic articles (David & Romagnesi, 1972). The collections LYAD 1323 and 1400 were tetrapolar and had a normal nuclear behavior. The latter were incompatible but the confrontations performed with the European (French) monosporous cultures from LYAD 726 of P. arcularius were negative. However the confrontations between an American collection of P. arcularius (LYAD 1171, Louisiana, Plaquemines Parish, Louisiana Riverside Campus, leg. A. David 12.VIII.72) and the French collection LYAD 726 were positive and also produced a fertile fruitbody in culture. This proves the isolation and independence of this species with regards to P. arcularius in the European sense.

18

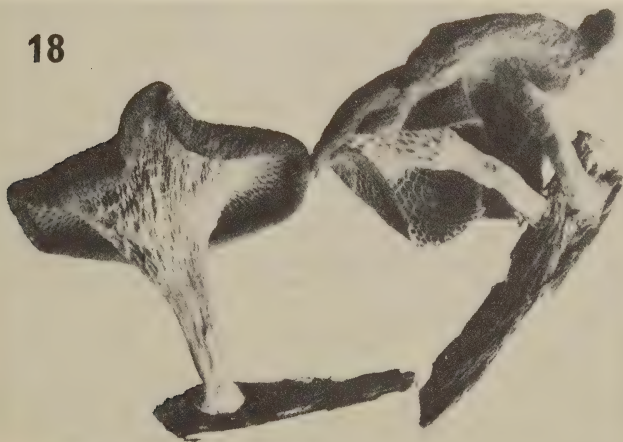


Fig. 18, Polyporus arcularioides (holotype): fruitbodies (x 1,5).

Polyporus cf. dictyopus Mont.

LYAD 1406 G, Natural Park, 6.VIII.72; LYAD 2120 G, Piolet's Youth Village, Deux Mamelles route, 25.IX.76; LYAD 1711 GI, Cayenne, P. Berthet I.74; LYAD 1719 GI, Crique Grégoire, P. Berthet I.74 .

Polyporus guianensis Mont.

LYAD 2152 G, Jules' Forest road, 27.IX.76; LYAD 1720 GI, Saül's environs, P. Berthet I.74; LYAD 1724 GI, Mahury Hills, P. Berthet 30.XII.73; LYAD s.n. GI, P. Berthet X.68, two collections.

Polyporus lepieurii Mont.

LYAD 2270 G, Douville region, X.76; LYAD s.n. GI, P. Berthet X.68, three collections

Polyporus puttemansii Henn.

LYAD 1408 G, Sofaïa region, 7.VIII.72.

The collection from the French Antilles is similar to the illustrations published as P. puttemansii Henn. by Lloyd (1912, fig. 486) and as P. wrightii Murr. (op. cit., fig. 487). The latter is a misnamed collection as P. wrightii is a synonym of Polyporus guianensis Mont. -quite a different species- as stated by Fidalgo & Fidalgo (1967). The following description is furnished from LYAD 1408:

Fruitbody stipitate, mesopod; pileus circular, umbilicate, 5 cm diam. and 0,25 cm thick. Margin entire, regular and thin; pileus surface finely velutinate under the lens, beige 2,5YR 5/6 5/8 4/6 4/8. Pores 1-2 per mm towards the margin, elongated toward the stipe up to 1,5 cm long but not decurrent. Context and tubes up to 2 mm thick at the base. Stipe 3 cm long, 0,4 mm wide toward the pileus, 0,8 mm wide toward the base, finely velutinate, dark chestnut 5YR 2/4.

Hyphal system dimitic. Generative hyphae simple-clamped 2-6,5 µm diam.; skeletal hyphae thick-walled, profusely branched, flexuose and irregular, 1,5-5-(6,5) µm diam. Basidia claviform, tetraspored, 20-28 x 6-7,5 µm. Spores cylindric, hyaline, 8-10 x 3-4 µm, inamyloid and acyanophilous.

The species is tetrapolar:

$$\begin{array}{ll} A_1B_1: 3 & A_2B_2: 5-9 \\ A_1B_2: 2-8-10 & A_2B_1: 4-6-7 \end{array}$$

Polyporus tricholoma Mont.

LYAD 2134 G, Basse Terre, Corrosol river, 24.X.76; LYAD s.n. GI, two collections, P. Berthet X.68; LYAD 1401 M, Contrebandiers' path Atlantic side, 5.VIII.72; LYAD 1312 M, La Trace road, 17.VII.72; LYAD 1344 M, region between Grand Riviere and Macouba, 25.VII.72 .

Cultural and sexuality studies of the species have been undertaken by Roy & De (1977). Nuclear behavior is normal (observations made from LYAD 1401). Sexuality is tetrapolar:

$$\begin{array}{ll} A_1B_1: 2-5-6-9-10-11-14-15-16-17 & A_1B_2: 1-8 \\ A_2B_2: 3-4-7-12 & A_2B_1: 13-18 \end{array}$$

Poria carneola Bres.

LYAD 1390 G, path leading to Garbet falls, on lying log in a banana plantation, 3.VIII.72; LYAD 1965 G, Ecrevisses cascade, J.Boidin 29.VII.75; LYAD 1979 G, Piolet's road, in natural park, J.Boidin 12.VIII.75; LYAD 2157 G, Petit Bourg, towards the INRA's laboratory J.Boidin 28.IX.76; LYAD 2165 G, Deux Mamelles route, road leading from the Forest House, 30.IX.76; LYAD 2261 G, Douville, 7.X.76 .

Descriptions of this species were given by Lowe (1966) and Ryvarden & Johansen (1980). We will present here the results of cultural studies undertaken with cultures LYAD 1965 1979, 2152 and 2165.

SPORES AND GERMINATION: spores are uninucleate, germinate in 6-10 days after shedding, and produce primary mycelia with simple septate coenocytic articles. The principal axes of the mycelium have long and branched terminal cells with hundreds of nuclei. The following are two assays of nuclei made from the terminal cell backwards:

720-112-52-35

436-210

The collateral and narrower axes have a smaller number of nuclei: up to 45 in the terminal cells but 2-10 in the intercalary ones.

SEXUALITY: bipolar (from LYAD 1965)

A₁: 1-4-6-8-9-10-12-13-14-15-16-17-18

A₂: 2-3-5-7-11-19

POLYSPERM:

Growth: dishes are covered in 2 wk (except LYAD 1979 which covered them in 3 wk).

Aspect of the mat: margin irregular, dendroid and adhering to the agar. Aerial mycelium little developed, webby, dendroid, at first white, becoming yellowish 7,5Y 9/6, 5Y 8/8 or ochre yellow 10YR 7/10. This coloration corresponds in cultures 1965, 1979 and 2152 to the formation of diffuse fructifications without pores, with the hymenium directly arranged on aerial hyphae. In cultures 2165 and 2152 a diffuse ochre-yellow coloration of 1 mm depth is seen in the agar under the aerial mycelium. Moreover, small cartilaginous and translucent plates are present in culture 2165.

Microscopy: margin formed with generative hyphae at first poorly branched, simple-septate 2,5-4 µm diam.; at 1-1,5 cm from the margin narrower branches with simple-clamps appear, with short 30-70 µm long branches covered with bacilliiform crystals. Aerial mycelium with simple septate generative hyphae, 3-6,5 µm wide with narrower simple-clamped hyphae 1,5-3,5 µm diam. All the hyphae are covered with bacilliiform crystals. Submerged hyphae are regularly simple-clamped with thin or thickened hyaline walls. When thickened they are associated to a 'cloud' of crystals that recall the structure of snow (fig. 18) and confer the yellowish colour to the agar; only a small quantity of these crystals are free in the agar. Fructifications: all the hymenial elements appear in bouquets on aerial hyphae. Lanceolate to claviform thick-walled cystidia are abundantly present, incrustated or not (fig. 19).

Cytology: irregularly clamped hyphae have some regularly binucleate articles and other moderately coenocytic: 12-1-2-2-1
9-5-1-2-2

Simple-septate hyphae are, on the contrary, strongly coenocytic with dozens of nuclei in the terminal cells.

When deeply submerged in liquid media (anaerobiosis) the polyspermic mycelium loses completely its clamps and becomes totally coenocytic as in the primary mycelium.

Oxidases: guaiacol 0,02%: ++++ to +++++, 0-1 cm

guaiacol 0,2 %: + to +++

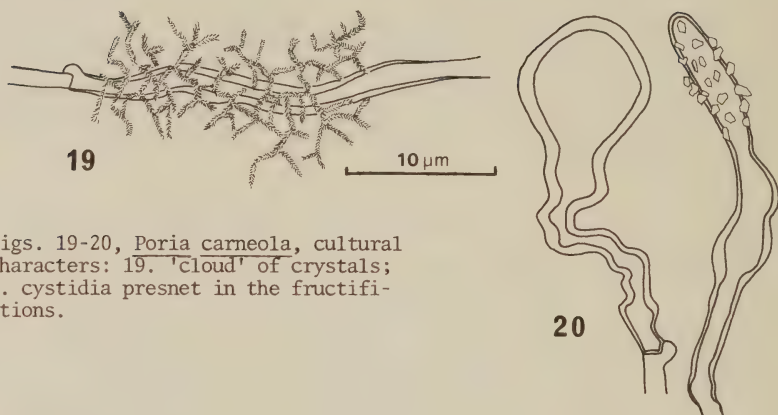
p-crésol: -, tr.

gallic ac.: + to ++++

tyrosine: -

NUCLEAR BEHAVIOR: astatocoenocytic.

CODE: 2a. 3s. 4. 7. 14. 32. 36. (37). 39. 42.43. (48).
50. 54. 59. 65.



Figs. 19-20, *Poria carneola*, cultural characters: 19. 'cloud' of crystals; 20. cystidia presnet in the fructifications.

REMARKS: *Poria carneola* Bres. had been included by Ryvarden (1972) in *Incrustoporia* Dom. (a nomenclatural synonym of *Skeletocutis* Kotl. & Pouz., see Keller, 1979, and David, 1982 a) because of the presence of incrustated hyphae in tubes and dissepiments. Keller excluded this possibility by showing that the crystal's structure in *P. carneola* was different from that in *Skeletocutis* species. On the other hand the strong incrustation present in several hyphae that overpass the hymenium suggests the possibility of considering them intermediate structures with truly incrustated cystidia (lamprocystidia); in such case, a clear relation with species pertaining to *Junghuhnia* Corda could be established. Nevertheless, cultural, cytological and sexuality data eliminate this possibility and also excludes it from *Skeletocutis*, i.e., *Junghuhnia* has tetrapolar species with normal nuclear behavior (David, unpublished) and *Skeletocutis* has tetrapolar species with heterocytic nuclear behavior (David, 1982a) and both have regularly simple-clamped hyphae in culture.

For these reasons we prefer to maintain *P. carneola* in the artificial genus *Poria* until its affinity is more evident.

Poria lenis (Karst.) Sacc.

LYAD 1966 G, As de Pique road, J. Boidin 31.VII.75 .

Porogramme albocincta (Cke. & Masee) Lowe

LYAD 2190 G, Deux Mamelles route, 3.X.76; LYAD 2200 G, Grosse Montagne, Petit Bour side, 4.X.76; LYAD 2208 G, Morne Léger, 6.X.76.

The species was described by Lowe (1964) and Ryvarden & Johansen (1980); typification problems were treated by Ryvarden (1979). We present here cultural studies made with the polysperms LYAD 2190 and 2208.

POLYSPERM:

Growth: very rapid, dishes covered in 1-2 wk.

Aspect of the mat: margin regular and adherent to the agar. Aerial mycelium adherent to the agar when young, appearing combed, the medium seen by transparency: inoculum surrounded by pure white, cottony mycelium. From the third wk on there appears a chestnut orange coloured crust 2,5YR 6/12 6/10 5/10, 10R 4/10, with pigment diffusion in depth in the agar which exhibits a variety of ochraceous hues tending to red 10R 4/10 5/10, to orange 2,5YR 6/14 6/10 or to yellow 10YR 8/8. With age the texture of the mycelial mat becomes different in both cultures: in LYAD 2190 the coloured crust, not covered by mycelium, is wrinkled--wavy and waxy; in LYAD 2208 the coloured crust is covered with a white cottony mycelium. From the fourth wk on there appears in depth in the agar a bouquet of white rhizomorphs of up to 1 cm long (fig. 20).

Microscopy: margin with simple-clamped generative hyphae of 3-5 μ m diam. At 1 cm of the margin there appear a great number of spheric to prismatic thin-walled arthrospores 4-5 times longer than wide. Aerial mycelium, the white zone is formed by: a) simple clamped generative hyphae 1,5-4,5 μ m diam. that give rise to b) pseudoparenchyma whose articles are very thick-walled (1,5-2,5 μ m), c) regularly branched thick-walled fiber hyphae 0,8-2 μ m diam., d) numerous arthrospores. Coloured zone: formed by a much differentiated and separable crust, formed by a pseudoparenchyma whose strong appressed and intertwined elements are embedded in an ochraceous amorphous substance. Rhizomorphs are formed by a pseudoparenchyma covered by undifferentiated generative hyphae.

Cytology: articles of the polyspermic mycelium are binucleate. Neohaplonts obtained from the polyspermic mycelia LYAD 2190 and 2208 (grown in bile media) were uninucleate.

Oxidases: guaiacol 0,02%: +++++, 5-6 cm	p-crésol: -
0,2 %: +++++, 4 cm	tyrosine: -
gallic ac.: +++++	

NUCLEAR BEHAVIOR: normal.

CODE: 2a. 3c. 8. 11. 16. 35. 36. 37. 39. 40. 41. 42.
54. 61.

REMARKS: cultural characters of *P. albocincta* are identical to those of *Tinctoporellus epimiltinus* (Berk. & Br.) Ryv. (see Rajchenberg, 1983 b) having the same texture with coloured crust formation, same microscopic characters, presence of arthrospores and rhizomorphs (the latter not pointed out by Rajchenberg but verified in cultures of the species deposited in Lyon University, LYAD 2283 and LYAD 2284, fig. 21).

Rhizomorphs are not frequently found in axenic cultures of Polyporaceae. Cariological data was the same in both species, the binucleate polyspermic mycelium of *T. epimiltinus* (LYAD 2283 and 2284) gave uninucleate neohaplonts when grown in bile media and the nuclear behavior was normal in this species. Both species have also similar spore shape and have the particularity of intensively reddening the substratum. It seems therefore quite evident that *P. albocincta* and *T. epimiltinus* are two highly related taxa in spite of their respective disposition in the Corticiaceae and Polyporaceae. Nevertheless they are still kept separated because of their different macromorphology and hyphal system.

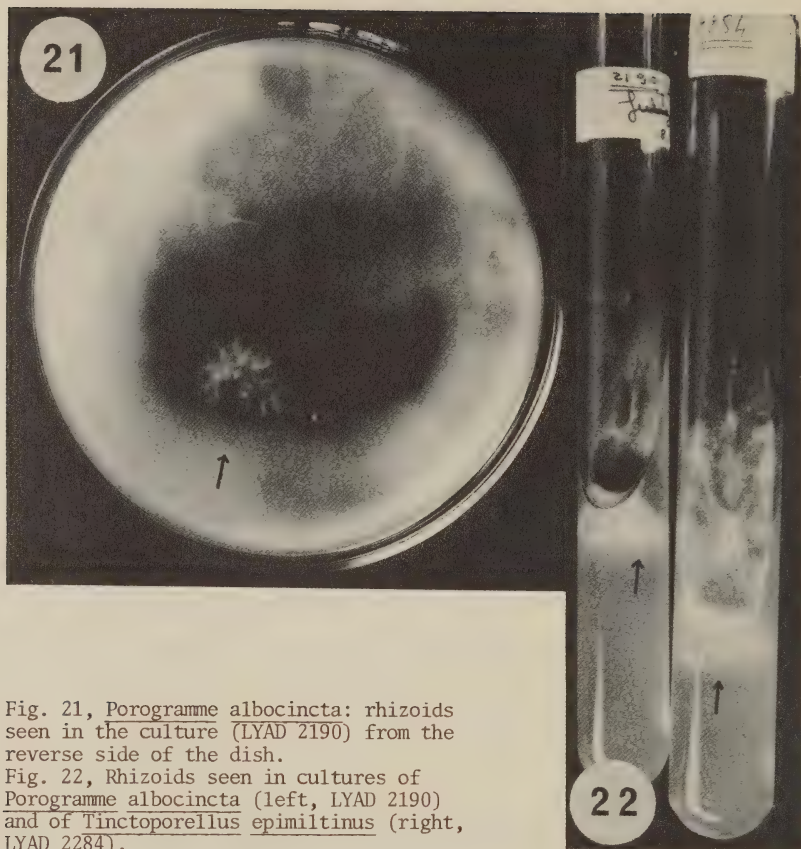


Fig. 21, Porogramme albocincta: rhizoids seen in the culture (LYAD 2190) from the reverse side of the dish.

Fig. 22, Rhizoids seen in cultures of Porogramme albocincta (left, LYAD 2190) and of Tinctoporellus epimiltinus (right, LYAD 2284).

Pseudofavolus cucullatus (Mont.) Pat.

LYAD 2126 G, Petit Bourg, 24.X.76; LYAD 2179 G, Lézarde forest, 30.IX.76; LYAD 1322 M, Précheur region, 19.VII.72 .

Pycnoporus sanguineus (L.:Fr.) Murr.

LYAD 1980 G, Petit David ford, J. Boidin 13.VIII.75; LYAD 2210 G, Morne Léger, 6.X.76.

Pyrofomes aurantiacus David & Rajchenberg sp. nov.

Basidiocarpio annuo vel perenni, resupinato, circulari vel ellipsoideus, in vivo pallido aurantiaco, in sicco castaneo aurantiaco. Poris 8-9 per mm. Margini tenui, anguste vel obsoleto. Contexto angustissimo 30-40 μ m lato, tubis in 1-2 stratis. Systema hypharum dimiticum. Hyphis generativis fibulatis, 1,5-3 μ m diam. Hyphis skeletibus sinuatis et ramosis 2-3,5 μ m diam., parietes incrassatis leviter castaneis, parce dextrinoideis cyanophilicisque. Basidiis claviformibus, tetrasporis,

12-14 x 5-7 μ m. Basidiospores copiosis, ellipsoideis truncatis 4,5-5,5 x 3-3,5 μ m, parietibus leviter incrassatis, indextrinoideis, cyanophilis. Holotypus LY-AD 2492 Guiane Gallica, Lacunae Rorota, Montis Mahury circa Cayenne, leg. P. Berthet 22.X.1968.

Fruitbody annual to perennial, resupinate, forming circular plates of 1-2 cm diam. or elongated ones 16 x 1 cm, 0,3 mm thick when young, up to 1,5 mm when mature. Pore surface palid orange when fresh 5YR 7/10 becoming chestnut orange when dried (around 2,5YR 5/10). Pores 8-9 per mm (but 6-7 per mm in one young specimen). Context extremely thin 30-40 μ m thick, tubes in 1-2 strata each up to 0,6 mm long; both concolorous withpores, darker with 5% KOH. Margin narrow to almost absent.

Hyphal system dimitic. Generative hyphae regularly simple-clamped 1,5-3,0 μ m diam., thin-walled. Skeletal hyphae very sinuous and branched, 2-3,5 μ m diam., thick-walled, sometimes solid, slightly chestnut, slightly dextrinoid and cyanophilous.

Basidia claviform, tetraspored, 12-14 x 5-7 μ m. Spores numerous, ellipsoid and truncate, 4,5-5,5 x 3-3,5 μ m (fig. 23) with slightly thickened walls, IKI -, cyanophilous.

Material studied: LYAD 2482 GI, Rorota Lakes, Mahury Massif, Cayenne environs, P. Berthet 22.X.68 (holotype); LYAD 2483 GI, Cayenne environs, P. Berthet 12.X.68; Chicago Nat. Hist. Mus. Exp. n° 198 (NY), Venezuela, Estado Bolívar, Chimantá Massif, 500-550 mts., 2nd growth clearing at Base Camp along Río Tirica, J.A. Steyermark and J.J. Wurdack 22.I.55.

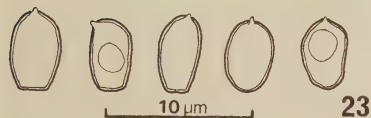


Fig. 23, Pyrofomes aurantiacus (holotype): spores

REMARKS: this species is placed in Pyrofomes Kotl. & Pouz. only because of the color of the fruitbody. There is a strong possibility that further studies may result in this genus being merged with Perenniporia Murr.

Pyrofomes aurantiacus was found to come close to Fomes fulvo-umbrinus Bres. which was described from Brazil (Blumenau) and also has a resupinate fruitbody with orange tubes and context. The type studied (S !) was identical in microfeatures with Perenniporia gomezii Rajch. & Wright (BAFC !) recently described from northern Argentine (Rajchenberg & Wright, 1982). Only the consistency and color of the fruitbodies are different, being woody and orange in F. fulvo-umbrinus and bony and brown in P. gomezii. Probably different growth and/or drying conditions are responsible for these differences. Fomes fulvo-umbrinus pertains to Pyrofomes Kotl. & Pouz. and the following new combination is proposed: Pyrofomes fulvo-umbrinus (Bres.) David & Rajchenberg comb. nov.; basionym: Fomes fulvo-umbrinus Bres., Hedwigia 35: 280, 1896 (S !), = Perenniporia gomezii Rajch. & Wright, Mycotaxon 15: 306, 1982 (BAFC !). This species differs from P. aurantiacus in having more massive fruitbodies (up to 1,5 cm thick), larger spores 7,3-9,4-(11,5) x

3-4-(4,7) μm , and peculiar thick-walled generative hyphae (see Rajchenberg & Wright, op. cit., for a detailed description).

Other orange-colored species described from South America are Pyrofomes lateritius (Cke.) Ryv. and P. perlevis (Lloyd) Ryv. which differ in being pileate and in having subglobose to globose truncate spores (Ryvarden & Johansen, 1980).

Rigidoporus biokoensis (Lloyd) Ryv.

LYAD s.n. GI, P. Berthet X.68, eight collections

Rigidoporus lineatus (Pers.) Ryv.

LYAD 1381 G, Natural Park, Basse Terre, 2.VIII.72; LYAD 1968 G, As de Pique path, J. Boidin 31.VII.75; LYAD 2267 G, Petit Bourg, 11.VII.76; LYAD 1337 M, between Morne Rouge and St. Pierre, 23.VII.72; LYAD 1339 M, Prêcheur region, 24.VII.72; LYAD 1356 M, between Anse Couleuvre and Grand Riviere, 28.VII.72; LYAD 2240 M, Plateau Michel, 10.VII.76 .

Rigidoporus microporus (Fr.) Overeem.

LYAD 1423 G, Basse Terre, Deux Mamelles route, 8.VIII.72; LYAD 1960 G, Natural Park, Ecrevisses cascade, 29.VII.75; LYAD 1338 M, Anse Couleuvre, 23.VII.72; LYAD 1351 M, Grand Riviere region, 28.VII.72 .

Rigidoporus vinctus (Berk.) Ryv. var. vinctus

LYAD 1412 G, Basse Terre, path leading from Grande Savane, 6.VIII.72; LYAD 2145 G, Jules' Forest road, 27.VIII.76; LYAD 2170 G, Lézarde forest, in front of a bamboo forest, 30.IX.76; LYAD 2253 G, Clark's Ravine forest, 10.X.76; LYAD 1315 M, La Trace, 17.VII.72; LYAD 1316 M, Morne Vert, 18.VII.72; LYAD 1362 M, path between Grand Riviere and Couleuvre's inlet, 28.VII.72; LYAD 2228 M, Pointe Rouge forest, 7.X.76 .

Rigidoporus vinctus (Berk.) Ryv. var. cinereus (Bres.) Setliff

LYAD 2214 G, Basse Terre, Morne Leger, 6.X.76 .

Schizopora carneo-lutea (Rodw. & Clel.) Kotl. & Pouz.

LYAD 1970 G, J. Boidin, 4.VIII.75; LYAD 2175 and 2184 G, Mamelles crossroad in the path leading from the Forest house, 30.IX.76; LYAD 2280 and 2282 G, Douville, 12.X.76 .

The collections from the French Antilles are very similar to the French ones. Intercompatibility tests or bullerisations were made between cultures coming from both regions (French cultures: LYAD 507, Atlantic Pyrenees, Pau region, on Fagus; LYAD 3577, Ain, Rena forest, on Quercus, 13.IX.78).

507 _I	x	2286 ₆	507 _I	x	2184
3577 _{II}	x	2286 ₆	507 _I	x	2282
3577 _{IV}	x	2286 ₆	507 _I	x	2175
			3577 _I	x	2184
			3577 _{III}	x	2282
			3577 _{II}	x	2184
			3577 _{II}	x	2184

All the results were positive which confirmed the cospecificity of all the collections.

Cultural and sexuality data were accomplished by several authors (e.g., Van der Westhuizen (1971), Domański (1969), and Stalpers (1978)). We shall only add here data referring

to the nuclear behavior: spores are uninucleate and give rise to simple septate mycelium with uninucleate articles; polysperm cultures are regularly dikaryotic. Nuclear behavior is, then, of the normal type.

Spongiporus af. leucomallellus (Murr.)David

LYAD 2161 G, Grand Montagne Forest road, 30.IX.76 .

Our collection consists of a small fruitbody of 2 x 4 cm that presents the distinctive elements of S. leucomallellus: gloecystidia that are more frequent at the bottom of the tubes. The only difference is the thin walls of the gloecystidia. In typical material the walls are thicker.

Tinctoporellus epimiltinus (Berk. & Br.)Ryv.

LYAD 1964 G, Ecrevisses cascade, J. Boidin 29.VII.75; LYAD 2283 and 2284 G, IX.76 .

Trametes maxima (Mont.)David & Rajchenberg comb. nov.

Basionym: Irpex maximus Mont., Ann. Sci. Nat. II, 8:364, 1837 .

LYAD 2131 G, Pointe Rouge de la Vigie, IX.76; LYAD 2191 G, St. Anne surroundings, 3.X.76; LYAD 1324 M, north of Prêcheur, 20.VII.72 .

Tetrapolar polarity and normal nuclear behavior (data obtained from LYAD 2131) exclude this species from Cerrena S.F. Gray where it was transferred by Kreisel (1971), because the type species, C. unicolor (Fr.)Murr., has binucleate spores (David, 1982 b).

Trametes membranacea (Sw.:Fr.)Kreisel

LYAD 1411 G, Basse Terre, path in the Sofaia region, 7.VIII.72; LYAD 1962 G, Ecrevisses cascade, J. Boidin 29.VII.75; LYAD 2139 G, Basse Terre, Jules' Forest road, 27.IX.76; LYAD 2156 G, Grosse Montagne Forest road, 30.IX.76; LYAD 2213 G, Basse Terre, road at right after beginning of Deux Mamelles route, 6.X.76; LYAD 1334 M, Montravail Forest, 22.VII.72; LYAD 1353 bis M, Grande Riviere region, 28.VII.72; LYAD s.n. M, Fort de France, 2 collections.

This species was described by Overholts (1953) as Polyporus tenuis (Sacc.)Overh. It differs from other typical Trametes Fr. species because its hyphal system has: a) skeletal hyphae 5-10 µm diam., unbranched, with thickened walls 0,5-2 µm but usually with a distinct lumen, b) typical binding hyphae, and c) vegetative hyphae with an intermediate structure between a and b, i.e., they appear as skeletal hyphae 4-8 µm diam. but with few to abundant short to long lateral almost solid branches 2-3 µm diam. (fig. 24).

We give here the cytological, cultural and sexuality data obtained from LYAD 1411, LYAD 2139 and BAFC 448 (Argentina, Misiones, Iguazú Nat'l Park, leg. M.Rajchenberg M-3486, 1.III.82).

SPORES AND GERMINATION: spores are uninucleate and germinate in 1-4 days, giving rise to simple septate hyphae with uninucleate articles.

SEXUALITY: tetrapolar,

LYAD 1411: A₁B₁: 1-6-8-9-12-16-17

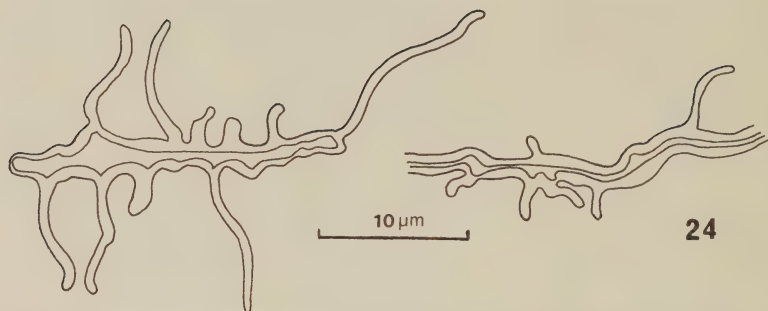


Fig. 24, *Trametes membranacea*: vegetative hyphae with intermediate structure between skeletal and binding hyphae.

LYAD 1411: A_2B_2 : 2-4-5-10

A_1B_2 : 3-7-15

A_2B_1 : 13-14

BAFC 448 : A_2B_1 : 5-8

A_1B_2 : 4-7

A_2B_2 : 2-3-10

A_2B_1 : 1-6-9

POLYSPERM:

Growth: rapid, covering the dishes in 2 wk.

Aspect of the mat: margin of regular growth and adherent to the agar. Aerial mycelium pure white, evenly raised, with slightly snowy aspect and with radial striae that begin in the inoculum and disappear with age; mycelium cobwebby, felty, with denser zones forming clusters that are more developed in the center and around the dishes. In BAFC 448 zones with white dense and pellicular mycelia are formed which are surrounded by waxy zones deprived of mycelium in the last weeks. Reverse bleaching from the first week on. Fructifications are formed from the 5th wk. on. Odor: none or fungic.

Microscopy: margin formed by simple clamped, little branched generative hyphae 2,5-5 μ m diam. Aerial hyphae formed by similar generative hyphae and others more branched and irregular with swollen portions 5-6-(10) μ m diam., narrower ones 2-3 μ m diam. All the hyphae are regularly simple-clamped and several hyphae have lipidic granulations in the innerside of the walls and are covered with bacilliform crystals. In BAFC 448 fiber hyphae 1,5-4 μ m diam. appear in the white mats; underneath and in the waxy areas a pseudoparenchyma develops that may cover all the dish. During the last weeks it becomes a plectenchyma because of the tight intermingling of cuticular hyphae with numerous sclerified and protuberant generative hyphae.

Cytology: articles are regularly binucleate.

Oxidases: guaiacol 0,02%: +++++

0,2 %: +

gallic ac.: +++++

p-crésol: -

tyrosine: -

NUCLEAR BEHAVIOR: normal.

CODE: 2a. 3c. (8). (11). 32. 36. 40. 42. 48. 54. 60. 61.

REMARKS: bullerisations made between the monosporic cultures BAFC 448₆₋₈ and the polysperm LYAD 2139 were positive.

Trametes modesta (Kunze ex Fr.)Ryv.

LYAD 1364 G, Deux Mamelles route, 30.VII.72; LYAD 1420, *ibid.*, Natural Park, 9.VIII.72; LYAD 2116 G, Corrossol region, 24.IX.76; LYAD 2121 G, Piolet Village in Deux Mamelles route, 25.IX.76; LYAD 2146 G, Jules' Forest road, Basse Terre, 17.IX.76; LYAD 2263 G, Jules' road, J. Boidin 8.X.76; LYAD 2272 G, Douville, 12.IX.76; LYAD 2279 G, Morne a Louis, X.76; LYAD 686 GI, Crique Grégoire, P. Berthet X.68 .

Trametes pavonia (Hook. in Kunth.)Ryv.

LYAD 1342 M, Montravail forest, 25.VII.72; LYAD 1314 M, La Trace, on Bambuseae, 17.VII.72; LYAD 2149 G, Petit Bourg, IX.76; LYAD 2271 G, Douville, 12.X.76; LYAD s.n. M, Fort de France, 2 collections.

Good descriptions of this species were given by Overholts (1953) and Fidalgo & Fidalgo (1966). Rajchenberg (1982) gave cultural data. Observations made on LYAD 1314 and 2149 showed that the species is tetrapolar with a normal nuclear behavior.

Trametes scabrosa (Pers.)Cunn.

LYAD s.n. GI, P. Berthet X.68; LYAD s.n. GI, Lassore Park, leg. S. Lucas .

Trametes villosa (Fr.)Kreisel

LYAD 2130 G, Pointe de la Vigie, 26.IX.76; LYAD s.n. GI, Cayenne, P. Berthet X.68, on Pagode tree; LYAD 1311 M, Fort de France, 16.VII.72; LYAD s.n. M, Fort de France, 3 collections.

Observations made from LYAD 2130 revealed that the species is tetrapolar with a normal nuclear behavior.

Trechispora regularis (Murr.)Liberta

LYAD 2254 G, Douville, 7.X.76 .

Trichaptum perrottetii (Lév.)Ryv.

LYAD 670 GI, P. Berthet X.68 .

See David (1970) for cultural, sexuality and nuclear behavioral data, under T. trichomallum (Berk. & Mont.)Murr.

Trichaptum sector (Ehrenb.:Fr.)Kreisel

LYAD 1375 G, Deux Mamelles route, 31.VIII.72; LYAD 1959 G, Gosier, J. Boidin, 27.VII.75; LYAD 668 GI, Crique Grégoire, P. Berthet X.68; LYAD 1716 and 1723 GI, Crique Grégoire, P. Berthet 22.I.74; LYAD 2479 GI, Sinamary, Vaudet's exploitation, on Amaranthaceae, S. Lucas VI.82 .

David (1970) published the cultural, sexuality and nuclear behavioral studies of this species.

Tyromyces duracinus (Pat.)Murr.

=Leptoporus duracinus Pat. (FH !)

LYAD 1968 G, starting of Victor Hughes' path, on the extremity of a dead stem, J. Boidin 2.VIII.75 .

Our collection fit very well the type and the descriptions given by Overholts (1953), Lowe (1975) and Ryvarden & Johansen (1980). Only the nature of the hyphal system needs explanation because Ryvarden & Johansen described it as probably monomitic "generative hyphae with clamps... present

also are some thick walled hyphae with rare clamps, in preparations these hyphae break off at the clamps and the long segments may easily be taken for skeletal hyphae". In fact, the hyphal system in the context is different from that in the trama. Although rare clamps may be seen on the 'skeletal hyphae' in the context, the hyphal system in the trama is distinctly dimitic. Also rare binding-like hyphae were seen in the type of Leptoporus duracinus Pat. (n° 958 herb. Patouillard, FH !) (fig. 25) but they may have been branched terminal hyphae of generative hyphae

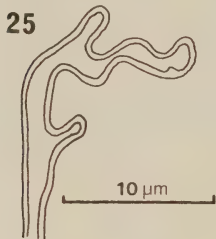


Fig. 25, Leptoporus duracinus (holotype): binding like hyphae .

Tyromyces palustris (Berk. & Curt.) Murr.

LYAD 1425 G, Deux Mamelles route, 10.VIII.76; LYAD 2141 G, Basse Terre, Jules' Forest road, 29.IX.76; LYAD 2159 and 2160 G, Grosse Montagne, Forest road, 30.IX.76; LYAD 2194, on a pilar in St. Anne plantation, 3.X.76; LYAD 2265 G, Amandiers' beach near St. Rose, 9.X.76; LYAD 2465 and 2468 GI, St. Laurent, S.Lucas I.82; LYAD 1310 M, Fort de France, 16.VII.72 .

Polyporus palustris was described by several workers, Overholts (1953), Bakshi (1971), Lowe (1975) and Wright et al. (1973) among others. Their opinions differ on the mitism of the species; for Lowe it is trimitic but Wright et al. describe a "sistema hifal monomítico..." . Our investigations with our collections and one exsiccata sent by Dr. Lowe (P. palustris n° 4826, U.S.A., Mississippi, on pine stump, leg. & det. J.L. Lowe 8.VIII.51) revealed the presence of solid hyphae that only differ from typical skeletal by the presence of clamps. The species seems to have a pseudodimitic hyphal system.

The monosporic cultures obtained from LYAD 1310 and LYAD 1425 were all intercompatible and also compatible with those obtained from the culture from CBS n° 28365 (P. palustris, leg. H.H. Mc Kay, on Pinus sp.) which fructified in culture.

NUCLEAR BEHAVIOR: the uninucleate spores germinate in 2-3 days giving rise a simple septate mycelium with uninucleate articles; the polysperm is regularly binucleate in each article. Nuclear behavior is, then, normal.

REMARKS: the affinities of T. palustris are still not clear. It can not be included in Tyromyces Karst. sensu stricto (as defined by David, 1980) because it produces a brown type of rot). The bipolar sexuality and the rapid germination of the spores excludes it from Spongiporus Murr. emend. David. It may be allied to the species in groups n° 18 and 19 of Nobles (1958). These species are grouped

together in Stalpers' work (1978), but studies on the sexuality, nuclear behavior and cultural characters as well as of the mitism of these species should clarify this possibility.

Tyromyces pusillus (Fr.)Cunn.

LYAD 2258 G, Douville, J. Boidin 7.X.76 .

Wrightoporia brunneo-ochracea David & Rajchenberg sp. nov.

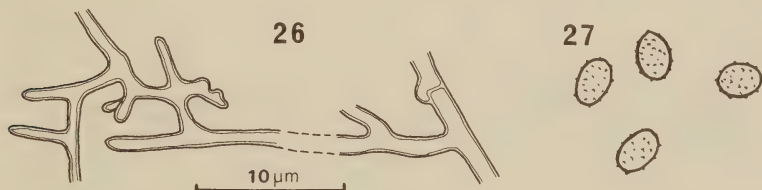
Basidiocarpio annuo effuso-reflexo, pileo 1 cm radii et 7 mm crasso, superficiei gossypina, scruposa, castanea. Poris 4-5 per mm, ochraceis. Contexto bicolorato. Margine sterile gossypino. Hyphis skeletibus contextus 2-6 μ m diam. indextrinoideis' hyphis generativis fibulatis 2-3,5 μ m diam. non ramificatis vel tenuis ramificatis 1-1,5 μ m diam. parietes tenuis vel leviter incrassatis aseptatis et hyphis colligantibus simulans. Trama cum structuram similis sed hyphis skeletibus dextrinoideis. Basidia non visu. Basidiolis claviformibus 7-10 x 4-5 μ m. Sporae numerosae, ellipsoideae, asperulatae, 3-3,5 x 2 μ m, amyloideae. Holotypus LY-AD 1415, Guadeloupe, Grande Savane, leg. A. David 6.VIII.1972 .

Fruitbody annual, effused-reflexed, with a pileus of 1 cm radius and 7 mm thick, abhymenial surface cottony, scrupose, chestnut 5YR 5/8 4/8, lighter at margin 10YR 8/6. Pore surface ochraceous 10YR 7/4. Pores irregular, 4-5 per mm, sometimes open and elongated up to 2 mm long. Context bicolor: one thin layer placed over the tubes and concolorous with them and the pore surface and one thicker and darker layer concolorous with the abhymenial surface 5YR 5/6. Margin sterile and cottony.

Hyphal system subtrimitic. Context with slightly chestnut, unbranched skeletal hyphae 2-6 μ m diam., indextrinoid, and generative hyphae regularly simple-clamped 2-3,5 μ m diam. with thin to slightly thick walls, that may give rise to narrower hyphae 1-1,5 μ m diam. with slightly thickened walls and clamps near the generative hyphae but lose them in the distal, much branched extremities (fig. 26); this kind of hyphae may be taken for binding. Trama with almost identical structure but skeletal hyphae are strongly dextrinoid and binding hyphae are less numerous.

Basidia not seen. Basidioles claviform 7-10 x 4-5 μ m. Spores very abundant, ellipsoid with hyaline, slightly thickened walls, 3-3,5 x 2 μ m asperulate (when seen with Melzer's reagent, but smooth when seen with 5% KOH solution), strongly amyloid (fig. 27).

Holotype: LYAD 1415 G, in a path in the Grande Savane region, on a vertical support, leg. A. David 6.VIII.1972 .



Figs. 26-27, Wrightoporia brunneo-ochracea (holotype): 26. binding-like hyphae; 27. spores .

AFFINITIES: this species has been included in Wrightoporia Kotl. & Pouz. because of the dextrinoid reaction of the skeletal hyphae of the trama. In fact the species presents intermediate characters between Wrightoporia Kotl. & Pouz. (with dextrinoid skeletal hyphae in the trama) and Amylonotus Ryv. (with indextrinoid and slightly chestnut skeletals in the context), thus the features which delimit these genera are uncertain.

Wrightoporia tropicalis (Cke.)Ryv.

LYAD 2143 G, Jules' Forest road, 27.IX.76 .

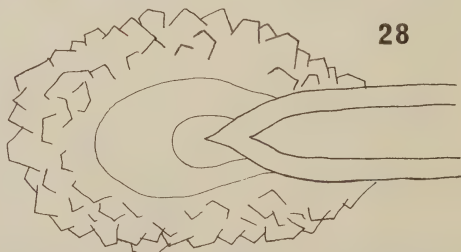
Descriptions of this species were given by Lowe (1966), Ryvarden (1982) and Ryvarden & Johansen (1980). The principal features of the species are: fruitbody resupinate and perennial, up to 1,5 cm thick, with indurated trama and dark greyish pore surface (but dark brown in the margin); dimitic hyphal system with simple septate generative hyphae and slightly dextrinoid skeletals; spores largely ellipsoid to subglobose, 3-4 x 2-3 μm , amyloid and finely asperulate; with incrustated cystidia and sulfo positive gloeocystidia.

Wrightoporia gloeocystidiata Johan. & Ryv. described from Kenya was placed in synonymy with Poria tropicalis (Cke.)Rick described from British Guiana (Ryvarden, 1983). In the same work Ryvarden pointed out some differences between the American and the African collections: a) absence of gloeocystidia in the American material; b) difficulty in finding clamps in the African collection whereas clamps were easier to find in the American specimens.

Our collection was compared with one from Ryvarden's herbarium (Kenya n° 9787) and another from NY (Venezuelan Expedition 1950-51 n° 29375, Amazonas, Río Orinoco, Río Cunucunuma, Playa Alta, 100 mts, leg. B. Maguire, R.S. Cowan and J.J. Wurdack 3.XI.50). From this study we can conclude that: a) All the collections have sulfo positive gloeocystidia; b) American collections differ in having abundant spheroid masses of crystals 15-20 μm diam. After dilution in acid the crystals were concentrically arranged around an amorphous substance which is itself disposed on the sharpened extremity of skeletal hyphae (fig. 28). These cystidia, already cited by Lowe were not seen in the African collection and distinctly separate South American and African materials; c) No clamps were found in any collection in spite of a persistent search .

Fig. 28,
Wrightoporia tropicalis
(neotropical collection):
cystidium .

10 μm



Wrightoporia tropicalis seems quite different from other members of the genus because of its massive habit and the absence of clamps. We want to emphasize that the assemblage

of highly specialized characters (ornamented amyloid spores plus sulfo positive gloeocystidia) is also found in other genera and families of very different Hymenomycetes (Glushchoff-Fiasson et al., 1983).

TREMELLACEAE

Aporpium dimidiatum David (LY !)

LYAD 2158 G, Grosse Montagne, Forest road, 30.X.76; LYAD 2220 M, Pointe Rouge forest, 7.X.76; LYAD 2245 M, in a plantation in Michel Plateau, 10.X.76 .

CONCLUSIONS

This work presents the list of species of Polyporaceae and other pore fungi gathered in the French Antilles principally during two expeditions of one month each during 1972 and 1976. This study has shown to have multiple interests. We have described five new species. For one of them, Wrightoporia brunneo-ochracea, the choice of a genus was not easy and we have hesitated between Amylonotus and Wrightoporia because the delimitation of both genera seems uncertain. In a similar way Pyrofomes aurantiacus was placed in that genus only because of macroscopic characters. Wrightoporia tropicalis and W. gloeocystidiata have an assemblage of characters (amyloid ornamented spores and sulfo positive gloeocystidia) which are found in other genera and families of Hymenomycetes morphologically different.

Judged by their European representatives the relation of the genera Antrodiella Ryv. & Johans. and Rigidoporus Murr. seems remote but the study of the tropical species has shown that these genera could be interrelated through the genera Flaviporus Murr. and Henningsia Möller, as is shown by the following table:

	Agglutinated hyphae	presence of clamps	spores	
			size	cyanophily
<u>Antrodiella</u>	-	+	< 4-5 μm	-
<u>Flaviporus</u>	+	+	< 4-5 μm	-
<u>Henningsia</u> (after Ginns 1979)	+	-	< 4-5 μm	+
<u>Rigidoporus</u>	+	-	> 4-5 μm	+

*Antrodiella onychoides (Egel.)Niemelä is a species whose hyphae are deprived of clamps but the fact that the articles are all uninucleate permits the assumption that the species may be parthenogenetic (David, unpublished).

In the genus Rigidoporus the articles are slightly coenocytic. Flaviporus subundatus presents all the characters of the genus Flaviporus but generative hyphae are simple-septate and their articles are also slightly coenocytic as

in Rigidoporus. R. dextrinoideus Johans. & Ryv., a species described from tropical East Africa, has acyanophilous ellipsoid spores which are intermediate in size between those found in Rigidoporus and Flaviporus. All these intergradations show the probable interrallation between these genera and stress the need to deepen the investigations, notably in the sense of cultural and cytological studies to solve taxonomic problems. When possible we have performed interfertility tests and studied nuclear behavior and cultural features. Such data are unknown in many tropical species.

The genus Hapalopilus Karst. is astatocoenocytic according to the European species, H. croceus (Fr.) Donk and H. nidulans (Fr.) Karst. and the same nuclear behavior was found in the tropical H. albo-citrinus (Petch) Ryv.

Sometimes unsuspected affinities are pointed out through the study of cultures as was the case in the presence of colored crusts and rhizomorphs in the cultures of Porogramme albocincta and Tinctoporellus epimiltinus. Once again it is shown that the hymenial configuration ought not to be considered an absolute character for family delimitation in Aphyllophorales.

The few interfertility tests that could be performed proved the identity of the French Antillean and Argentine collections of Grammothele subargentea, Nigroporus vinosus and Loweporus tephroporus (the latter also compatible with an African collection) which is not surprising since they came from New World countries. Tests also proved the conspecificity of French Antillean and European collections of Schizopora carneo-lutea.

The species collected in the French Antilles and Guiana were strictly neotropical, or pantropical or some were cosmopolitan in distribution. Interfertility criteria will solve problems of synonymy and clarify the patterns of distribution, and even evolution, of many species and genera. It is difficult to obtain cultures of many species from different countries and in consideration of the enormous task that this type of study implies it seems highly desirable that more collaboration should be established among mycologists interested in tropical floras.

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A D D E N D U M

Mycologists with the possibility of making shipments of fresh materials and/or spore prints from specimens of Polyporaceae are invited to join in monographic studies of any group in this family.

Collaboration should result in a scientific article.

A. David is now engaged in the study of the genera Perenniporia Murr., Nigroporus Murr. and Loweoporus Wright. M. Rajchenberg is interested in Poria sensu lato, stipitate polyporoids and Microporellus Murr.

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BASIDIOMYCETES THAT DECAY GAMBEL OAK IN SOUTHWESTERN COLORADO

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SUMMARY

Thirty wood-rotting Basidiomycetes are illustrated and described as decay fungi on Gambel oak (*Quercus gambelii* Nutt.) in southwestern Colorado. No brown rot fungi are included. *Inonotus andersonii* (Ell. et Ev.) Černý plays a role in creating habitats for cavity-nesting birds.

Gambel oak, *Quercus gambelii* Nutt., is the most abundant oak in the Four Corners area (at the intersection of state lines of Arizona, Colorado, New Mexico, and Utah). It extends northward throughout western Colorado at altitudes ranging from 990 to 3050 m and occurs in extreme southcentral Wyoming; its range extends farther north into the Utah panhandle, but it does not occur in the Uinta Mountains or the Great Basin area of Western Utah. All parts of Arizona and New Mexico, except the extreme west-southwest and east-southeast respectively, are included in the range of Gambel oak (Christensen, 1949; Christensen, 1949b). Records also exist from northern Sonora, Mexico, and extreme southern Nevada. Other *Quercus* spp. occur within the range of Gambel oak, but these occur mainly in southern Arizona and New Mexico.

Although Gambel oak is an important browse plant for deer and domestic animals such as sheep, and although it provides nesting sites for various animals, including cavity-nesting birds, there has been a concerted effort by range improvement groups to eradicate oak brush. In many cases eradication of brush has been demonstrated to increase beef gains dramatically (Marquiss and Norris, 1967).

Gambel oak is increasing in importance as a fuel species. Next to piñon pine, *Pinus edulis* Engelm., Gambel

oak produces the hottest fire of any native wood in the area. Stands of oak are easily accessible and plentiful for wood cutters.

Gambel oak is host to a large number of wood-rotting fungi in the Subdivision Basidiomycotina. These fungi include both parasites and saprophytes and are most conspicuous during the August - September rainy periods in southwestern Colorado. This paper is intended to be the first of a series enumerating and illustrating these fungi and describing their role in the ecology of Gambel oak.

Microscopic observations were made from free-hand sections and crush preparations in 3% KOH and phloxine. Camera lucida drawings were made with an Olympus LHB microscope. Numerical color names are from Munsell's Book of Color (Munsell, 1976); descriptive color names are the author's.

List of Species that Decay Gambel Oak

ALEURODISCUS CERUSSATUS (Bres.) Höhn. et Litsch., K. Akad.

Wiss. Wien Math.- Nat. Kl. Sitzungsab. 116: 807. 1907.

Basidiocarps on decorticated wood, resupinate, irregularly effused, buff to pinkish-buff in older regions (5YR 8/4 to 7.5YR 8/4), cracking on drying; margin white, thinning out to abrupt, not fertile. *Hyphal system* monomitic; subicular hyphae thin-walled, nodose-septate, 2-3.5 μm diam.

Pseudocystidia embedded, mammillate, some moniliform, with refractive contents, with a basal clamp, 49-66 x 10-13 μm .

Acanthohyphidia abundant, barely projecting, some thick-walled in the lower portions, with a basal clamp, (18)-30-40 x 2.5-7 μm . *Basidia* in a catagymenium, slender-clavate, 4-sterigmate, some with lateral acanthophysis-like projections, with a basal clamp, 40-42 x 6-7 μm .

Basidiospores hyaline, smooth, amyloid in Melzer's reagent, ovoid to ovoid-ellipsoid, 6-8 x 4.5-5.5 μm . *Voucher specimen* - JPL 1167.

ATHELIA BOMBACINA Pers., Mycol. Eur. 1:85. 1822.

Basidiocarps effused-resupinate, bright white (near 5PB 9/1); hymenium pellicular; margin narrow to lacking.

Hyphal system monomitic; subicular hyphae nodose-septate, thin-walled, hyaline, encrusted, 2-3 μm diam. *Sterile hymenial elements* lacking. *Basidia* clavate, 4-sterigmate, with a basal clamp, 16-18 x 4.5-5.5 μm . *Basidiospores* hyaline, smooth, negative in Melzer's reagent, narrowly ellipsoid to pip-shaped, with a distinct apiculus, 5-6 x 2-3 μm . *Voucher specimen* - JPL 1109.



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Fig. 1. *Aleurodiscus cerussatus*. (JPL 1167).

a) subicular generative hyphae; b) pseudocystidia; c) acanthohyphidia; d) basidia; e) basidium with acanthophysis-like branch; f) basidiospores.

BOTRYOBASIDIUM BOTRYOSUM (Bres.) John Erikss., Symb. Bot. Upsal. XVI:1, p. 53.

Basidiocarps resupinate, mealy to hypochnoid, becoming widely effused, pale yellowish-gray (near 5Y 8.5/2), on bark. *Hyphal system* monomitic; subicular hyphae simple-septate, thin-walled, hyaline, 6-7.5 µm diam; basal hyphae

similar but thick-walled. *Sterile hymenial elements* lacking. *Basidia* short-clavate, 4-6 sterigmate, with a simple septum at the base, $15-23 \times 7-10 \mu\text{m}$. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, limoniform and biapiculate, some germinating by repetition, $(6.5)-8-9 - (12) \times 5-6 \mu\text{m}$. *Comments* - I could find no reference in the literature to a *Botryobasidium* in which the spores germinate by repetition, but the phenomenon was quite common in this specimen. Spores in this specimen are more globose than indicated by Eriksson (1973). *Voucher specimen* - JPL 1165.

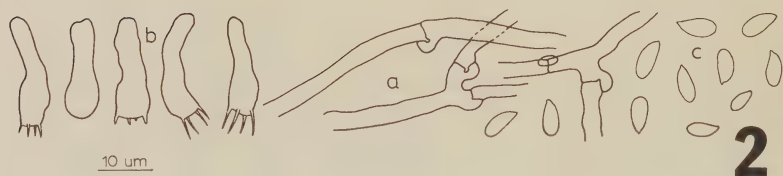


Fig. 2. *Athelia bombacina*. (JPL 1109).
a) subicular generative hyphae; b) basidia;
c) basidiospores.

HYPHODERMA PRAETERMISSUM (Karst.) John Erikss. et Strid,
in John Erikss. et Ryv., *The Corticiaceae of North
Europe* 3:505. 1975.

Basidiocarps bright white, effused-resupinate, appearing floccose to arachnoid under a 30X lens; margin abrupt, fertile. *Hyphal system* monomitic; subicular hyphae thin-walled, nodose-septate, $3-5 \mu\text{m}$ diam. *Cystidia* capitate, thin-walled, projecting, with a basal clamp, $55-65 \times 3.5-6 \mu\text{m}$. *Gloeocystidia* embedded, fusiform, sinuous, thin-walled, with a basal clamp, $50-88 \times (5)-6-10 \mu\text{m}$. *Stephanocysts* embedded in deep subiculum, two-parted, the terminal cell thin-walled, expanded and balloon-like, the subterminal cell smaller, with a ring of spine-like projections subtending the terminal cell, and with a basal clamp, $22-24 \times 12-13 \mu\text{m}$, some appearing to germinate. *Basidia* cylindric-clavate, 4-sterigmate, $28-36 \times 6.5-8.5 \mu\text{m}$, with a basal clamp. *Basidiospores* hyaline, smooth,

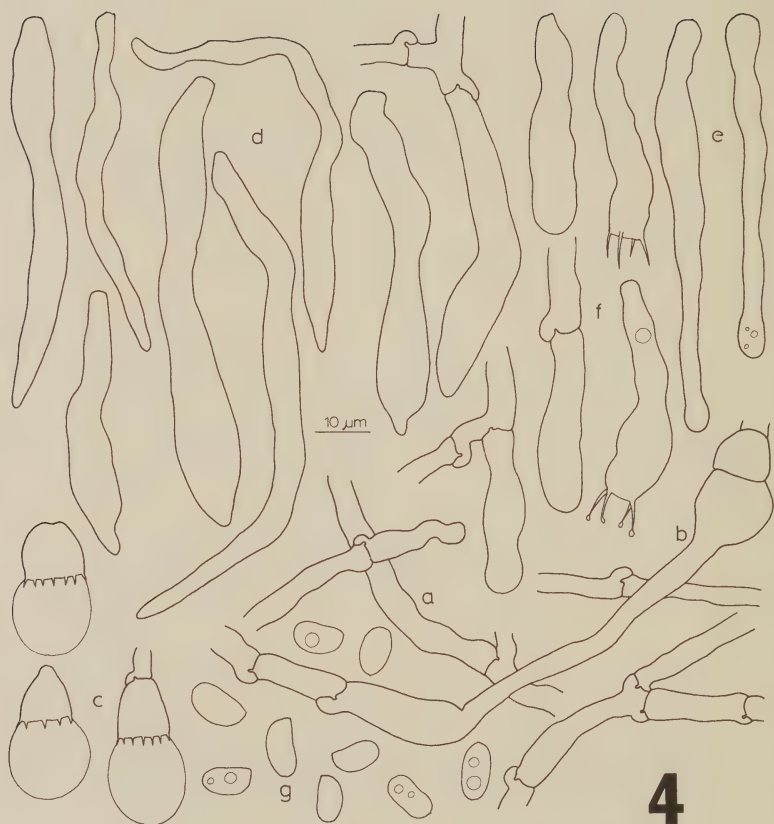
negative in Melzer's reagent, ellipsoid-cylindric, somewhat allantoid, $7-9 \times 4-5 \mu\text{m}$. *Voucher specimens* - JPL 1071, JPL 1175.



Fig. 3. *Botryobasidium botryosum*. (JPL 1165). a) subicular hyphae; b) basidia; c) basidiospores; d) basidiospores germinating by repetition.

HYPHODONTIA CRUSTOSA (Fr.) John Erikss. Symb. Bot. Upsal. XVI:1, p. 104. 1958.

Basidiocarps off-white to cream-color (near 2.5Y 9/4), circular patches erupting through bark or effused on decorated wood, aculeate with fimbriate apices to the aculei, the aculei fairly regularly spaced, 2-3 per mm; subiculum smooth to cracked between the aculei; margin white, sterile, appressed-floccose. *Hyphal system* monomitic; subicular hyphae somewhat thick-walled, nodose-septate, $2.5-3.5 \mu\text{m}$ diam. *Cystidioles* present, particularly in the



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Fig. 4. *Hyphoderma praetermissum*. (JPL 1071).
 a) subcicular hyphae; b) stephanocyst germinating;
 c) stephanocysts; d) fusoid gloeocystidia; e)
 capitate cystidia; f) basidia; g) basidiospores.

tips of the aculei, $30-51 \times (3)-4-7 \mu\text{m}$, with a basal clamp. *Basidia* slender, clavate, often constricted in the middle, 4-sterigmate, $22-35 \times 4-5 \mu\text{m}$, with a basal clamp. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, often with a single, large guttule, cylindric-ellipsoid, $6-7.5 \times 3-4 \mu\text{m}$. *Voucher specimens* - JPL 1066; JPL 1097; JPL 1145.

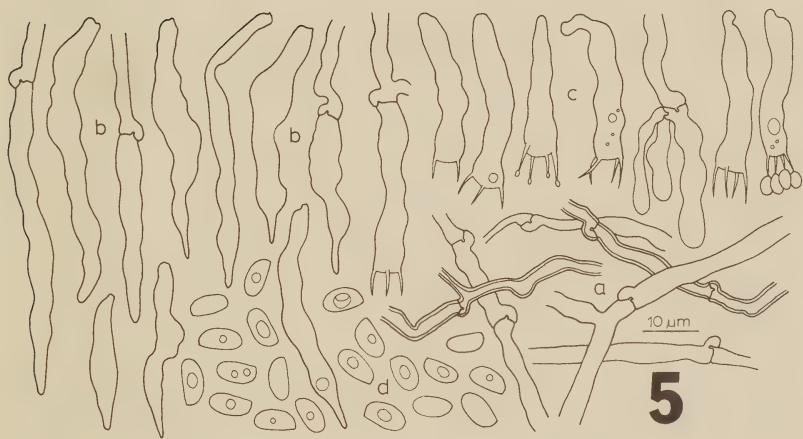


Fig. 5. *Hyphodontia crustosa*. (JPL 1066, 1097, & 1145). a) subicular hyphae; b) fusoid cystidioles; c) basidia; d) basidiospores.

HYPHODONTIA SUBALUTACEA (Karst.) John Erikss. Symb. Bot. Upsal. XVI:1, p. 104. 1958.

Basidiocarps resupinate, effused, thin, porose-reticulate to furfuraceous, in some places with blunt aculei, cream-colored (near 2.5Y 8/4); margin thinning out, arachnoid. *Hyphal system* monomitic; subicular generative hyphae thin-walled, nodose-septate, $3-3.5 \mu\text{m}$. *Cystidia* abundant, wider toward the apex, thick-walled toward the basal clamp, $65-115 \times 7.5-8.5 \mu\text{m}$, often projecting. *Basidia* clavate, 4-sterigmate, often with a median constriction,

17-21 x 4-5 μm . *Basidiospores* hyaline, smooth, negative in Melzer's reagent, allantoid, 6.5-9 x 1.5-2.5 μm .

Comments - JPL 1100 was somewhat odontoid, but was, for the most part, reticulate-poroid. Eriksson and Ryvarden (1976) indicate that *H. subalutacea* and *H. floccosa* intergrade. JPL 1100 obviously demonstrates this problem but spore size and the relative paucity of teeth indicated its placement in *H. subalutacea*. *Voucher specimen* - JPL 1100.

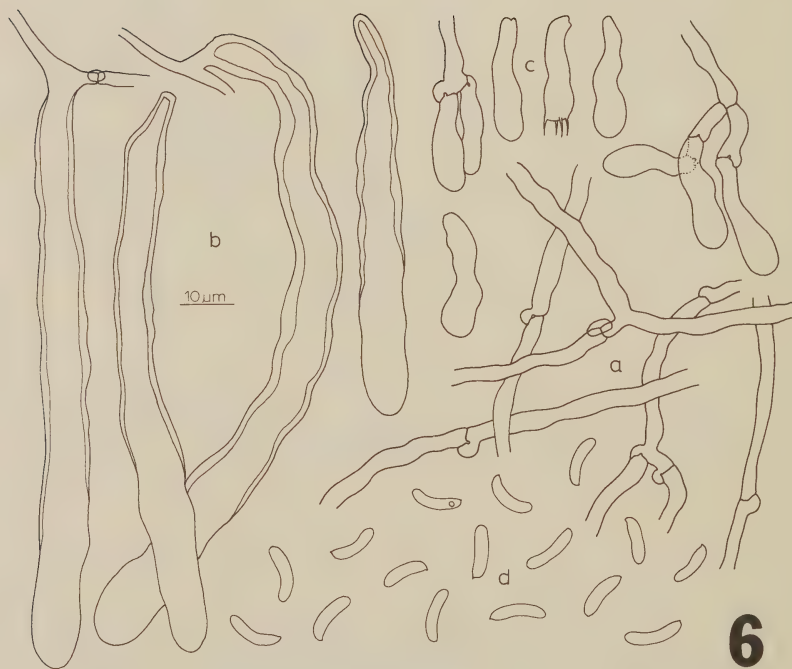


Fig. 6. *Hyphodontia subalutacea*. (JPL 1100).
a) subicular hyphae; b) cystidia; c) basidia;
d) basidiospores.

PENIOPHORA NUDA (Fr.) Bres., Rovereto Accad. Sci. Lett.

Arti Agiati, Atti. ser. III vol. III p. 114. 1897.

Basidiocarps adnate, resupinate, becoming widely effused, dry, pinkish-buff, (near 7.5YR 9/2 to 10YR 8/2), cracking at maturity; margin abrupt to finely tomentose, white, sterile. *Hyphal system* monomitic; subicular hyphae nodose-septate, thin-walled, branched, 3.5-4.5 μm diam. *Gloeocystidia* cylindric to vesicular, some tapering, blackening in sulfobenzaldehyde, with refractive contents, 42-48 x 8.5-11.5 μm , with a basal clamp. *Lamprocystidia* thick-walled, heavily incrustated up to 2/3 of their length, tapering, 30-55 x 7-8 μm . *Basidia* clavate, 4-sterigmate, 22-30 x 5-6 μm , with a basal clamp, occurring in dense candelabrams. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, cylindric to suballantoid, 7.5-8.5 x 3-3.5 μm . *Voucher specimen* - JPL 1094.

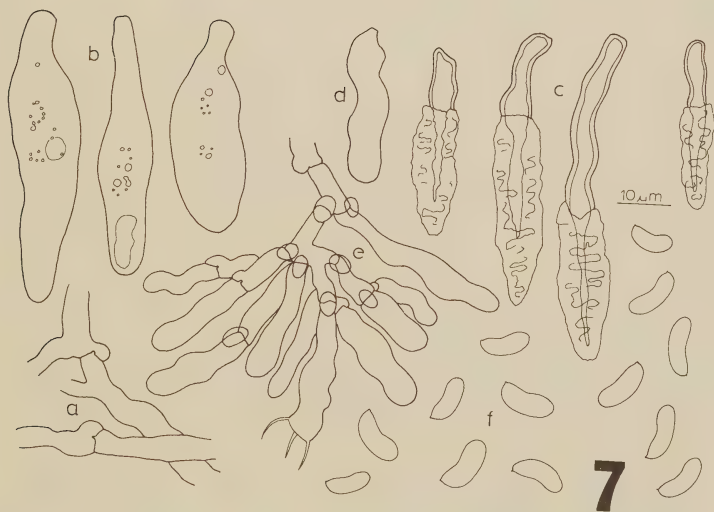


Fig. 7. *Peniophora nuda*. (JPL 1094). a) sub-
icular hyphae; b) gloeocystidia; c) incrustated
cystidia; d) immature basidium; e) basidial
candelabrum; f) basidiospores.

PENIOPHORA PSEUDOVERSICOLOR Boid. Bull. Mens. Soc. Linn.

Lyon 34:162. 1965.

Basidiocarps resupinate, starting as elongated patches and becoming effused 10-15 cm; smooth to slightly tuberculate, cracking upon drying, pinkish-to orangish-grey (near 5YR 7/4 to 7.5YR 6/4); margin thinning out to abrupt. *Hyphal system* monomitic; subicular hyphae hyaline, thin-walled, nodose-septate, 2.5-3.5 μ m diam. *Gloeocystidia* cylindric to clavate, some slightly fusiform, 38-75 x 8-13 μ m, with a basal clamp. *Lamprocystidia* embedded, thick-walled, incrusted up to $\frac{1}{2}$ their length, blunt-tipped to pointed, 33-37 x 5-7 μ m. *Basidia* cylindric to narrow-clavate, some with secondary septa, 4-sterigmate, with a basal clamp, 29-47 x 4.5-6 μ m. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, cylindric-allantoid, 6.5-8 x 2.5-3.5 μ m. *Comments* - This fungus has not been previously reported from North America, but it fits Jülich and Stalpers' description (1980) very well. It is very common on decorated Gambel oak slash in the *Pinus ponderosa* - *Quercus gambelii* type in southwestern Colorado. *Voucher specimens* - JPL 1108; JPL 1168; JPL 1211.

PENIOPHORA VIOLACEOLIVIDA (Sommerf.) Masee, J. Linn. Soc.

Lond. Bot. 25:152. 1890.

Basidiocarps adnate, resupinate, smooth to irregularly tuberculate, (near 7.5YR 8/2) greyish-blue; young fruiting bodies roughly orbicular; margin narrow, white, fimbriate-tomentose. *Hyphal system* monomitic; subicular hyphae thin-walled, nodose-septate, 3-4 μ m diam. *Gloeocystidia* cylindric-clavate, some tapering, embedded, with refractive contents, staining black in sulFOBenzaldehyde, 37-49 x 7.5-14 μ m, with a basal clamp. *Lamprocystidia* thick-walled, tapering, encrusted up to $\frac{1}{2}$ their length, 45-50 x 6-9 μ m, with a basal clamp. *Basidia* cylindric-clavate, 4-sterigmate, some repeating, 26-32-(47) x 5-6 μ m, with a basal clamp, occurring in candelabrams. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, slightly allantoid, 7.5-9-(12) x 2.5-3 μ m. *Voucher specimen* - JPL 1064.

PHANEROCHAETE TUBERCULATA (Karst.) Parm., Consp. Syst.

Cort. p. 83. 1968.

Basidiocarps becoming widely effused, white to cream or ochraceous (near 5Y 9/2 to 2.5Y 9/4), smooth to tuberculate, often cracking on drying; margin white, fibrillose, with white rhizomorphs. *Hyphal system* monomitic; hyphae thin-walled, simple-septate (subicular hyphae rarely show-



Fig. 8. *Peniophora pseudoversicolor*. (JPL 1108 & 1168). a) subicular hyphae; b) gloeocystidia; c) incrusted cystidia; d) basidium; e) basidiospores.

ing single to double clamps), 3-3.5 μm diam. *Sterile hymenial elements* lacking. *Basidia* cylindric-clavate, 4-sterigmate, 25-35 x 5.5-6.5 μm , with a simple septum at the base. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, short cylindric, 4.5-6.5-(7) x 3-4 μm . *Voucher specimen* - JPL 1070.



Fig. 9. *Peniophora violaceolivida*. (JPL 1064).
 a) subicular hyphae; b) gloeocystidia; c) incrus-
 tated cystidia; d) basidium; e) basidiospores.

PHANEROCHAETE VELUTINA (DC.:Fr.) Jülich, Willdenowia
 7:274. 1972.

Basidiocarps annual, widely effused, resupinate; hymenial
 surface pinkish-orange, 7.5YR 9/2 to 5YR 8/4, sometimes
 cracking on drying; margin often with white rhizomorphs.
Hyphal system monomitotic; subicular hyphae thin- to thick-

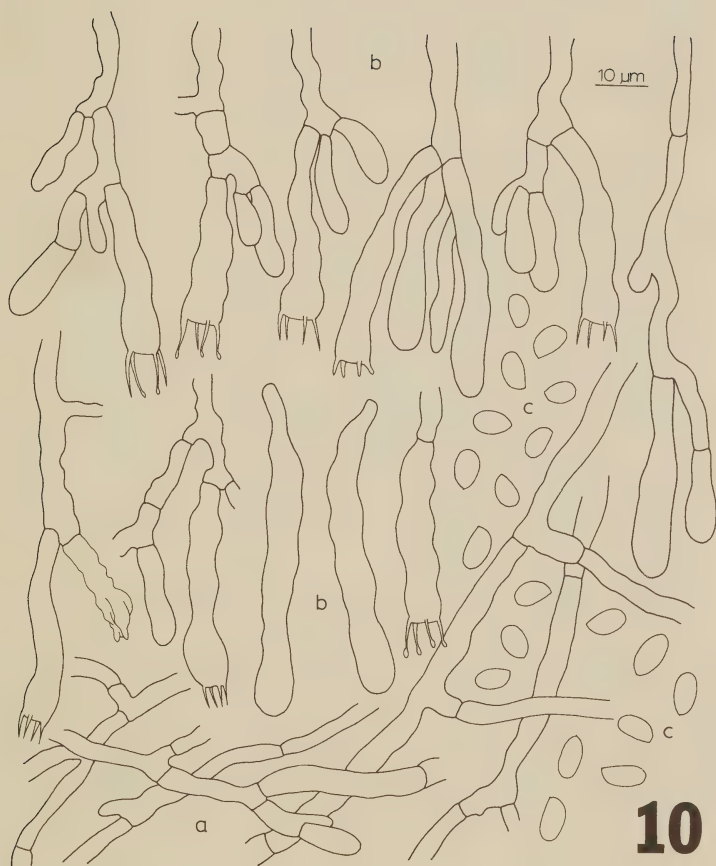


Fig. 10. *Phanerochaete tuberculata*. (JPL 1070).
a) subicular hyphae; b) basidia; c) basidiospores.



Fig. 11. *Phanerochaete velutina*. (JPL 1093 & 1095). a) simple-septate and nodose-septate subicular hyphae, some with double or multiple clamps; b) incrustated cystidia; c) basidia; d) basidiospores.

walled, mostly simple-septate but some with single to multiple clamp connections, 4 to 7 μm diam. *Lamprocystidia* numerous, thick-walled, heavily incrustated with coarse crystals, 10 to 15 μm wide and up to 165 μm long, projecting up to 60 μm , with a basal simple septum. *Basidia* narrowly clavate, 4-sterigmate, 32-42 x 5-6.5 μm , simple-septate at the base, often in candelabrams. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, short-cylindric, (4)-5.5-7 x (2.5)-3-4 μm . *Voucher specimens* - JPL 1093, JPL 1095, JPL 1096.

PHLEBIA ALBIDA v. Post. in Fr., Monogr. Hym. Suec. II
p. 280, 1863.

Basidiocarps waxy to horny, orbicular and patchy to widely effused-resupinate to effused-reflexed, white to reddish-brown (near 5YR 5/8 to 5YR 3/4 to 10YR 5/8); hymenial surface irregularly warted to radiately folded to hydroid; margin finely fimbriate. *Hyphal system* monomitic; generative subicular hyphae thin- to slightly thick-walled, gelatinized, 2-3.5 μm diam. *Sterile hymenial elements* lacking. *Basidia* long-clavate to cylindric, 4-sterigmate, 25-36 x 4-5 μm , with a basal clamp. *Basidiospores* ellipsoid, flattened on adaxial side, hyaline, smooth, negative in Melzer's reagent, 5-7.5 x 3-4 μm . *Voucher specimens* - JPL 1037; JPL 1053; JPL 1068.

SISTOTREMA BRINKMANNII (Bres.) John Erikss., K. Fysiogr.
Sallsk. Lund. Forh. 18: 134. 1948.

Basidiocarps thin, white to grayish (near 10YR 9/2), pelticulate, easily separable. *Hyphal system* monomitic; generative hyphae nodose-septate, thin-walled, 2-3.5 μm diam. *Sterile hymenial elements* lacking. *Basidia* utriform, 4-6 sterigmate, with a basal clamp, 18-19 x 4.5-5 μm ; basidioles present. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, ellipsoid, allantoid, 3.5-4.5 x 1-1.5 μm . *Voucher specimen* - JPL 1088.

TUBULICRINIS CALOTHRIX (Pat.) Donk, Fungus 26:14. 1956.

Basidiocarps thin, floccose, whitish (near 5PB 9/1); cystidia obvious under 30X lens. *Hyphal system* monomitic; generative subicular hyphae thin-walled, nodose-septate, 3-7 μm diam. *Cystidia* amyloid, thick-walled, tapering toward the apex, capillary lumen gradually widened, 67-88 x 8-12 μm , with a basal clamp. *Basidia* clavate, 4-sterigmate, 18-25 x 5 μm , with a basal clamp. *Basidiospores*

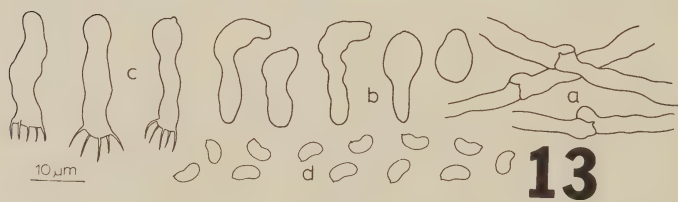
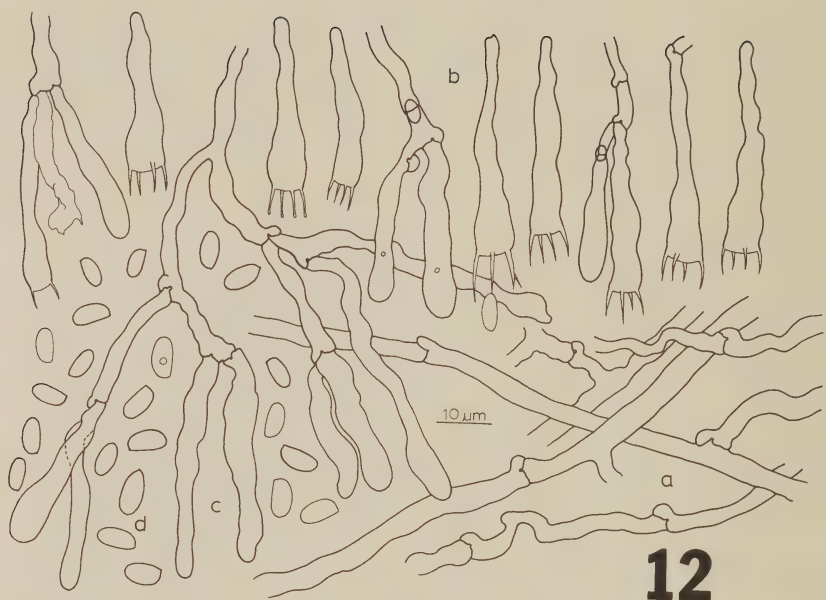


Fig. 12. *Phlebia albida*. (JPL 1037, 1053, & 1068). a) subcicular hyphae; b) basidia; c) basidial candelabrum; d) basidiospores.

Fig. 13. *Sistotrema brinkmannii*. (JPL 1088). a) subcicular hyphae; b) basidioles; c) mature basidia; d) basidiospores.

hyaline, smooth, allantoid, negative in Melzer's reagent, $5.5-6 \times 1-1.5 \mu\text{m}$. *Voucher specimen* - JPL 1060.

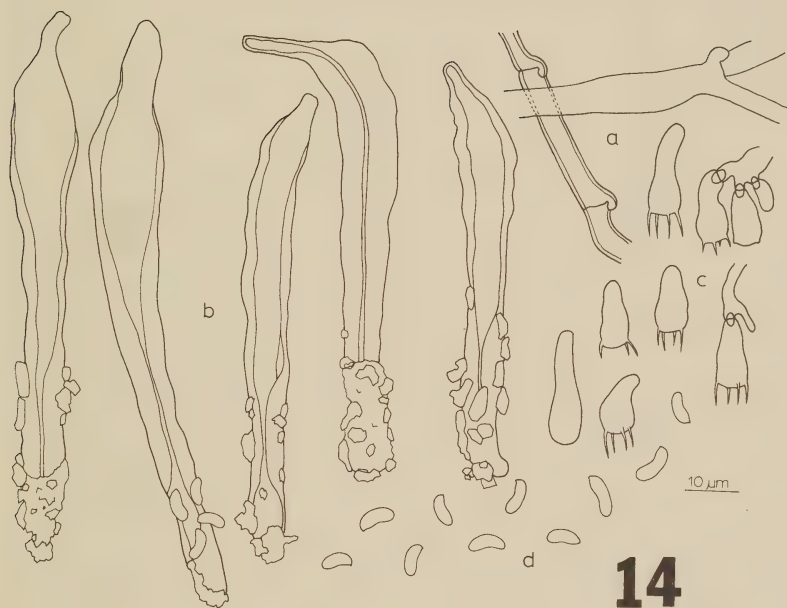


Fig. 14. *Tubulicrinis calothrix*. (JPL 1060).
a) subicular hyphae; b) incrustated cystidia; c) basidia; d) basidiospores.

TOMENTELLA FERRUGINEA (Pers.) Pat., Hym. d'Eur., p. 154. 1887.

Basidiocarps effused-resupinate, appressed but separable, felty, rust-colored (near 2.5Y 3/2); margin sterile (near 10YR 4/8), fimbriate, appearing slightly strigose under 10X lens. *Hyphal system* dimitic; generative hyphae thin-to thick-walled, some simple-septate, $3.5-4 \mu\text{m}$ diam, others nodose-septate, $4-5 \mu\text{m}$ diam; skeletal hyphae thick-

walled, aseptate, 3.5-4 μm diam; cordons of two kinds, nodose-septate generative and skeletal. *Sterile hymenial elements* lacking. *Basidia* cylindric-clavate, 4-sterigmate, often with one or more secondary septa, 33-43 x 6-8.5 μm , with a basal clamp. *Basidiospores* pale brown, several lobed or irregular, echinulate, 7-8 x 5-6 μm . *Voucher specimens* - JPL 1079; JPL 1092.



Fig. 15. *Tomentella ferruginea*. (JPL 1079).
a) nodose-septate subicular hyphae; b) simple-septate subicular hypha; c) skeletal hypha; d) basidia; e) basidiospores.

TOMENTELLA RAMOSSISSIMA (Berk. et Curt.) Wakef., *Mycologia* 52: 927. 1960.

Basidiocarps resupinate, widely effused up to 15 cm, smooth, dark reddish-umber (near 5YR 2/4 to 5YR 2/2),

felty. *Hyphal system* monomitic; subicular hyphae brown, thick-walled, nodose-septate, 5.5-7.5 μm diam. *Sterile hymenial elements* lacking. *Basidia* stoutly cylindric, 4-sterigmate, with a basal clamp, 36.5-49 X 9-12 μm . *Basidiospores* globose, aculeate, light brown in KOH, negative in Melzer's reagent, 7.5-9 μm diam. *Voucher specimen* - JPL 1099.

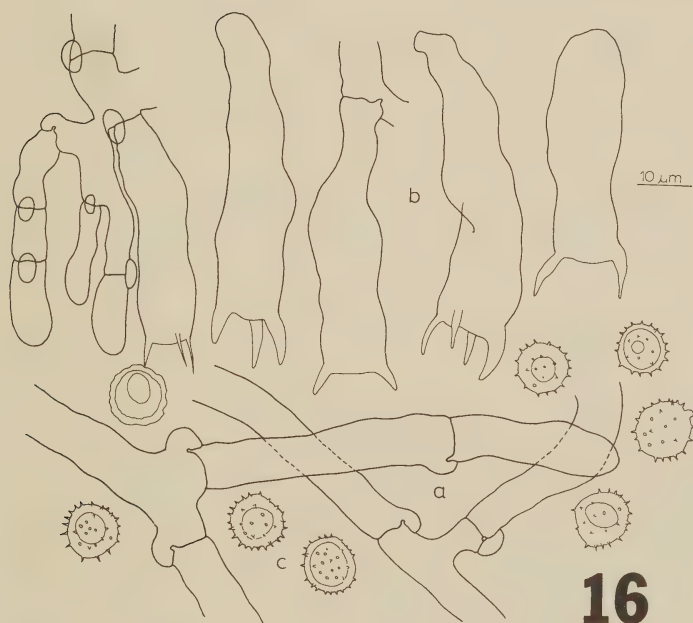


Fig. 16. *Tomentella ramossissima*. (JPL 1099).
a) subicular hyphae; b) basidia; c) basidiospores.

STECCHERINUM FIMBRIATUM (Pers.:Fr.) John Erikss., Symb.

Bot. Upsal. XVI:1, p. 134. 1958.

*Basidiocarp*s effused-resupinate, easily separable; hymenial surface hydnnaceous, teeth apically fimbriate, light pink (near 5YR 8/4) fading to white at the margin; margin thinning out, strongly fimbriate and rhizomorphic. *Hyphal system* dimitic; subicular generative hyphae thin-walled, nodose-septate, 3.5-6.5 μm diam; skeletal hyphae thick-walled, hyaline, aseptate, often terminating as incrusted skeletocystidia, 2.5-4.5 μm diam. *Skeletocystidia* heavily incrusted, thick-walled, up to 80 μm long and 5-11 μm diam, arising from skeletal hyphae. *Basidia* clavate, 4-sterigmate, 17-20 x 4.5-5 μm , with a basal clamp. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, 4-5 x 2.5-3 μm . *Voucher specimen* - JPL 1102.



Fig. 17. *Steccherinum fimbriatum*. (JPL 1102).
 a) generative hyphae; b) skeletal hyphae; c) skeletocystidia; d) basidia; e) basidiospores.

DACRYMYCES MINOR Peck, Ann. Rep. N.Y. State Mus. 30:49.
1877.

Basidiocarps punctate, pulvinate, gelatinous, orange, drying near 5YR 3/6, 1-2 mm diam. *Hyphal system* monomitic; hyphae simple-septate, frequently branched, 2-3 μ m diam. *Sterile hymenial elements* lacking. *Basidia* bifurcate; hypobasidium up to 60 μ m long and 4-5 μ m wide; epibasidia up to 20 μ m long, 3-4 μ m wide at maturity. *Basidiospores* hyaline, smooth, broadly allantoid, negative in Melzer's reagent, 1-2 celled, with a distinct blunt apiculus, often with 1 or more guttulae, 9-14 x 4-6 μ m. *Voucher specimen* - JPL 1111.

EXIDIA GLANDULOSA Fr., Syst. Mycol. 2:224. 1822.

Basidiocarps irregular, dark brown to black, gelatinous when moist, drying horny. *Hyphal system* monomitic; generative hyphae nodose-septate, intricately and irregularly branched, 1.5-5 μ m diam. *Basidia* cruciately-septate; hypobasidium 13-17.5 x 8-10 μ m at maturity, with a basal clamp; epibasidia 4, 13-20 x 2-3 μ m at maturity. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, allantoid, 11-15 x 3-4.5 μ m. *Voucher specimen* - JPL 1067.

HYMENOCHAETE ARIDA Karst., in Sacc., Syll. Fung. 9:228.
1891.

Basidiocarps tomentose, setose under a 20X lens, effused, mostly resupinate but curling slightly at the edges, muddy brown (near 5YR 3/4), dry, not cracking appreciably on drying; margin fertile, abrupt. *Hyphal system* monomitic; subicular hyphae simple-septate, thin- to moderately thick-walled, branched, light brown, darkening in KOH, 3-5 μ m diam. *Setae* subulate to ventricose, thick-walled, brown, ensheathed with primary wall material, simple-septate at the base, 60-120 x 5.5-8 μ m, projecting up to 60 μ m. *Basidia* slender-clavate, 4-sterigmate, 17-20 x 3.5-5 μ m, with a simple septum at the base. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, ellipsoid to short-cylindric, 4-4.5 x 2-2.5 μ m. *Voucher specimen* - JPL 1069.

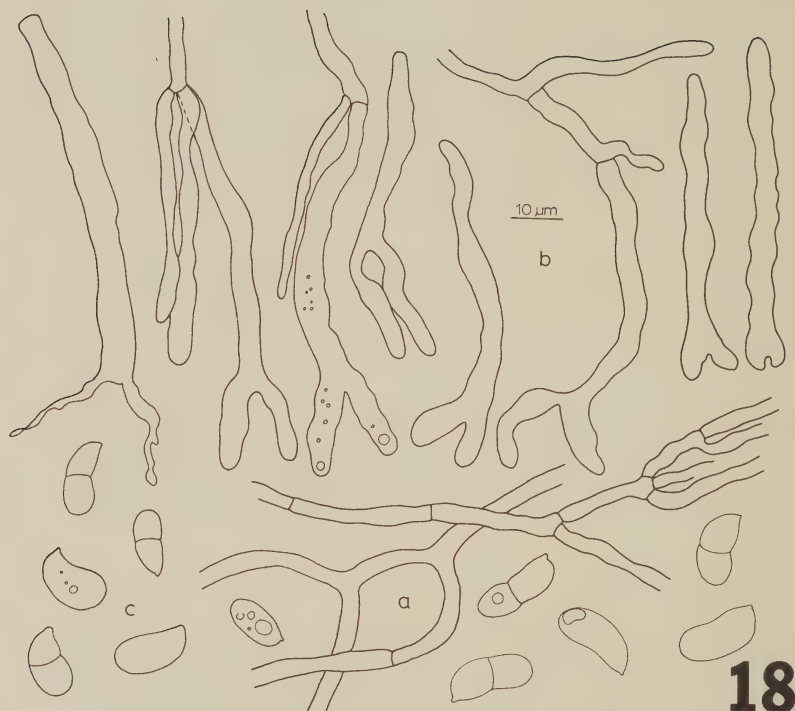


Fig. 18. *Dacrymyces minor*. (JPL 1111).
 a) subicular hyphae; b) basidia; c) basidio-
 spores.

INONOTUS ANDERSONII (Ell. et Ev.) Černý, Česka Mykol. 17:1. 1963.

Basidiocarps annual, sometimes effused over entire surface of wood in branches or standing snags, developing under the bark or outer sapwood layers and causing decortication, resupinate but often with thick outgrowths of tubes that may appear almost pileate; deep golden-brown (from mass

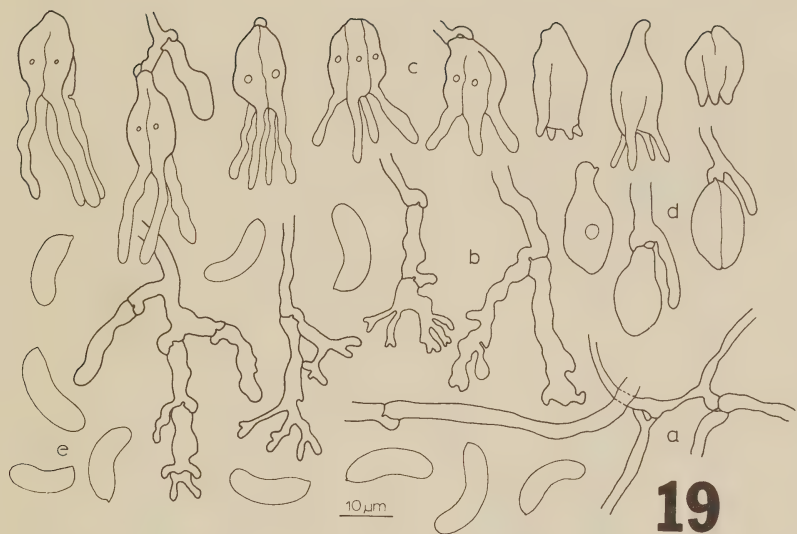


Fig. 19. *Exidia glandulosa*. (JPL 1067).

- a) subicular hyphae; b) dendrohyphidia;
c) mature basidia; d) immature basidia;
e) basidiospores.

spore deposits) to dark brown to black (in older, disintegrating parts of the basidiocarp) (near 10YR 5/10 to 10YR 4/8 to 10YR 3/4); pores 1-4 per mm, with lacerate dissepiments as specimens age; margin abrupt, concolorous, fertile. *Hyphal system* dimitic; generative tramal hyphae hyaline to light yellow, simple-septate, 2-3 μm diam; contextual skeletal hyphae thick-walled, brown (darkening in KOH solution), some with secondary septa, 3-6 μm diam. *Setae* frequent, thick-walled, dark brown, ventricose, slightly projecting or embedded, 29-54 $\times$ 6.5-8.5 μm ; setal hyphae frequent to lacking. *Basidia* clavate, 4-sterigmate, simple-septate at the base, 14-17 $\times$ 5-6.5 μm . *Basidiospores* yellowish to yellowish-green (Campbell and Davidson, 1963), thick-walled, negative in Melzer's reagent,

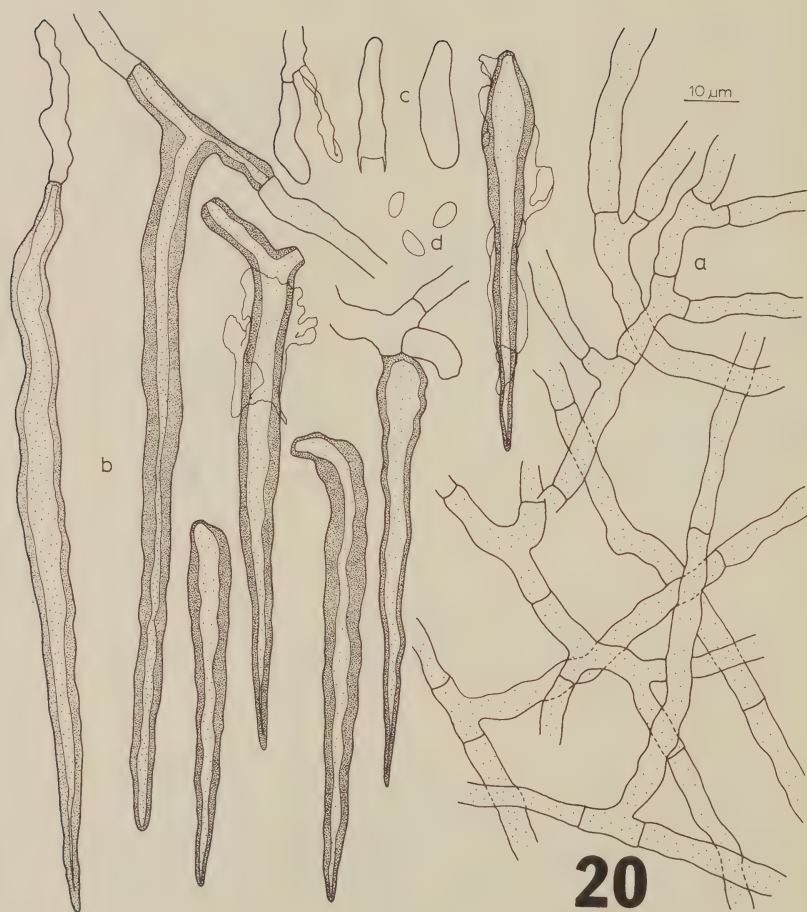


Fig. 20. *Hymenochaete arida*. (JPL 1069).
a) generative hyphae; b) setae; c) basidia;
d) basidiospores.

oval to broadly ellipsoid, 5-8 x 4-6 μm . *Comments* - *I. andersonii* is extremely common in southwestern Colorado, and probably follows Gambel oak to the northern extension of its range as it does with other *Quercus* species. However, the small boles of the clonal scrub oak stands in this area probably do not offer as much opportunity for formation of infection courts as do larger Gambel oaks in southern Arizona and New Mexico. Thus one sees this fungus in areas only where Gambel oak has not been recently burned or cut over, and where larger oaks have had time to develop. *I. andersonii* is important in its contribution to creation of habitats for cavity-nesting birds such as the red-shafted flicker. *Voucher specimens* - JPL 898; JPL 1138.

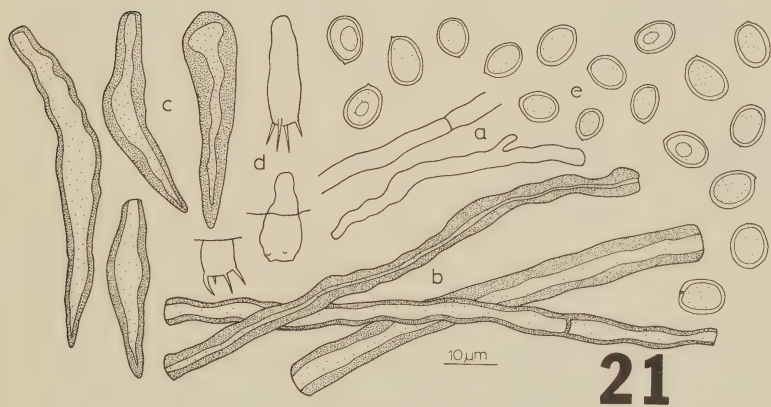


Fig. 21. *Inonotus andersonii*. (JPL 898 & 1138).
a) generative hyphae; b) skeletal hyphae; c) basidia; d) basidiospores.

INONOTUS DRYOPHILUS (Berk.) Murr., Bull. Torrey Bot. Club. 31:597. 1904. Fig. 6.

Basidiocarps annual, sessile, solitary, hoof-shaped, with a golden-brown (near 10YR 7/8), tomentose, often zonate upper surface; pore surface golden-brown (near 10YR 6/6), aging to reddish-brown, pores angular, 1-3 per mm; context

with a granular core, speckled in appearance due to alternating light yellow and reddish-brown areas (near 7.5YR 3/6), and with a shiny, golden, fibrous layer between the tubes and the core. *Hyphal system* monomitic; hyaline hyphae from granular core thin-walled, simple-septate, 3-5 μm diam, some inflated up to 13 μm ; hyphae from fibrous context thick-walled, simple-septate, light brown, 3-6 μm diam; tramal gloeoplerous hyphae lightly pigmented, simple-septate, 3-5.5 μm diam; hyphae from granular core thick-walled, darkly pigmented, contorted, breaking up into bluntly pointed seta-like structures, up to 15 μm diam. *Setae* and setal hyphae lacking. *Basidia* clavate, 4-sterigmate, with a simple septum at the base, 14-18 x 4-6 μm . *Basidiospores* brownish, thick-walled, smooth, negative in Melzer's reagent, ellipsoid, appearing somewhat truncate, 6-7.5 x 4-5 μm . *Comments* - This fungus is probably the most common cause of heartrot in fairly small diameter (10-15 cm) Gambel oaks, where the conks are often as large in diameter as the host. *Voucher specimens* - JPL 1091; JPL 1179.

PHELLINUS FERRUGINOSUS (Schrad.:Fr.) Bourd. et Galz., Hym. France. p. 625. 1928.

Basidiocarps perennial, widely effused, adnate; pore surface cocoa brown (near 7.5 YR 3/4 to 7.5 YR 5/8); pores 4-5 per mm, dissepiments thick; margin sterile, rusty (near 7.5YR 4/8), felty, up to 1.5 cm wide; context felty, concolorous with margin, azonate. *Hyphal system* dimitic; generative contextual hyphae thin- to thick-walled, simple-septate, 2.5-3 μm diam; skeletal contextual hyphae thick-walled, aseptate, 2.5-3.5 μm diam; all thick-walled hyphae dark brown in KOH. *Setae* subulate, somewhat ventricose, dark brown in KOH, thick-walled, 29-62 x 4.5-11 μm . *Setal hyphae* present in marginal tissue, 130-330 μm long. *Basidia* short-cylindric to subglobose, 4-sterigmate, 8.5-12 x 5 μm , simple-septate at the base. *Basidiospores* short-cylindric to oblong, hyaline, smooth, negative in Melzer's reagent, 5-6.5 x 3.5-4.5 μm . *Voucher specimens* - JPL 1104; JPL 1123.

POLYPORUS ARCULARIUS Batsch:Fr., Syst. Mycol. 1:342. 1821.

Basidiocarps annual, centrally stipitate, cartilaginous; pileus with a central depression, glabrous, wrinkled, tan (near 10YR 7/4), with a fringed margin; pore surface whitish; pores hexagonal and radially aligned; stipe lightly tomentose, concolorous with pileus. *Hyphal system*

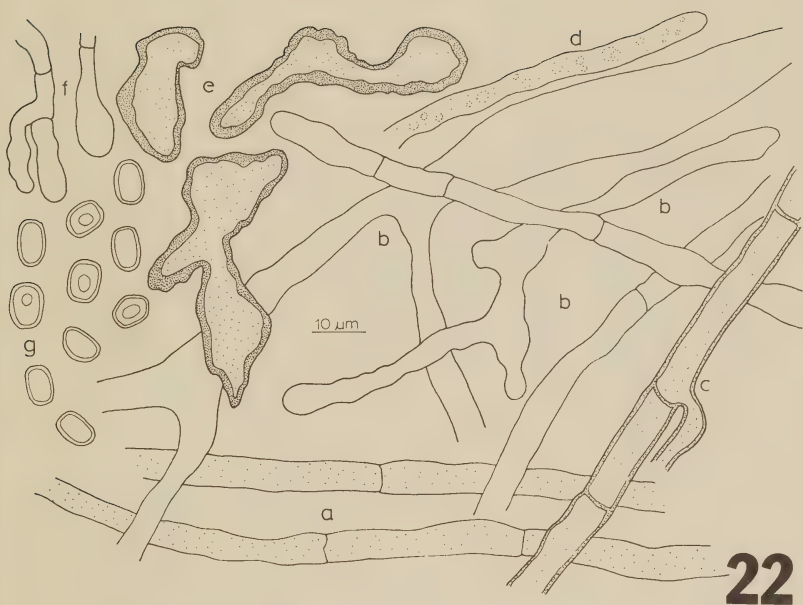


Fig. 22. *Inonotus dryophilus*. (JPL 1091).

a) lightly pigmented tramal hyphae; b) hyaline hyphae from granular core; c) lightly pigmented hypha from fibrous layer of context; d) tramal gloeoplerous hypha; e) seta-like pigmented hyphal cells from granular core; f) basidia; g) basidiospores.

dimitic; generative hyphae hyaline, thin- to thick-walled, nodose-septate, 1.5-6 μm diam; skeletal hyphae richly branched, thick-walled, aseptate, 2.5-4.5 μm diam. Sterile hymenial elements lacking. Basidia narrowly clavate, 4-sterigmate, with a basal clamp, 22.5-30 x 4.5-6.5 μm . Basidiospores hyaline, smooth, negative in Melzer's reagent, cylindric, 7-9.5 x 1.5-3 μm . Comments - *P. arcularius* is one of the most frequently encountered fungi

on dead Gambel oak, both on slash and standing wood.
Voucher specimen - JPL 1169.



Fig. 23. *Phellinus ferruginosus*. (JPL 1104).
 a) generative hypha; b) skeletal hyphae; c) setae; d) basidia; e) basidiospores.

CERIPORIA EXCELSA (Lund.) Parm. Spor. Rast. 12:222. 1959. *Basidiocarps* annual, resupinate, becoming widely effused, whitish to pinkish-tan (near 7.5 YR 7/4); pores shallow, rounded, 3-4 per mm, with thick dissepiments; margin narrow, thinning out, sterile, whitish, floccose. *Hyphal system* monomitic; subicular hyphae hyaline, thin-walled, mostly simple-septate, often swollen at the septa and exhibiting whorled branching, 4-8.5 μm diam. *Sterile hymenial elements* lacking. *Basidia* short-clavate, 4-sterigmate, with a simple septum at the base, 12.5-16 $\times$ 4.5-5 μm , occurring in loose candelabrams. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, 4-5 $\times$ 3-3.5 μm . *Voucher specimens* - JPL 1087; JPL 1121.



Fig. 24. *Polyporus arcularius*. (JPL 1169).

a) thin-walled generative tramal hyphae; b) thick-walled generative tramal hyphae; c) branched skeletal hyphae; d) basidia; e) basidiospores.

PERENNIPORIA MEDULLA-PANIS (Fr.) Donk, Persoonia 5:76. 1967.

Basidiocarps annual to perennial, effused; pore surface white, drying off-white to reddish-brown (near 2.5YR 9/4); pores 3-5 per mm, round to irregular in shape and size; margin narrow, slightly reflexed, sterile, white, thinning out, felty. *Hyphal system* trimitic; generative hyphae thin-walled, nodose-septate, 2.5-3 μ m in diam; skeletal hyphae thick-walled, aseptate, 3-3.5 μ m diam; binding hyphae richly branched, 1.5-3 μ m diam; subicular tissue dextrinoid in Melzer's reagent. *Cystidioles* embedded, blunt-fusiform, 20-26 x 5-7 μ m, with a basal clamp; hyphal pegs present. *Basidia* short-clavate to subglobose, 4-sterigmate, 19-22 x 7-10 μ m, with a basal clamp. *Basidiospores* hyaline, smooth, thick-walled, often appearing truncate, dextrinoid in Melzer's reagent (reaction sometimes variable), ellipsoid to ovoid, 5.5-8.5 x 4-5 μ m. *Voucher specimen* - JPL 1059.



Fig. 25. *Ceriporia excelsa*. (JPL 1087).

a) simple-septate generative hyphae; b) whorled branching pattern of generative hyphae; c) basidia; d) basidiospores.

PERENNIPORIA TENUIS (Schw.) Ryv., Norw. J. Bot. 30:9. 1973.

Basidiocarps annual, widely effused, adnate; pore surface bright lemon yellow, fading on drying to yellow or cream (near 2.5Y 8.5/6); pores 3-5 per mm, circular to angular; margin tomentose, cream-colored, sterile; subiculum thin, concolorous with tube layer; tube layer up to 3 mm thick. *Hyphal system* dimitic; generative hyphae thin-walled, nodose-septate, 2-3 μm diam; skeletal hyphae thick-walled, aseptate, some branched and approaching binding hyphae, 2-3 μm diam. *Cystidioles* fusoid, embedded, 17-18 x 4.5-6 μm , with a basal clamp. *Basidia* short-clavate, 4-sterigmate, 16-22 x 5-6 μm , with a basal clamp. *Basidiospores* hyaline, smooth, negative in Melzer's reagent, ellipsoid to short-cylindric, some with a single, large guttule, 5-6 x 3-4.5 μm . *Voucher specimens* - JPL 1065; JPL 1126.

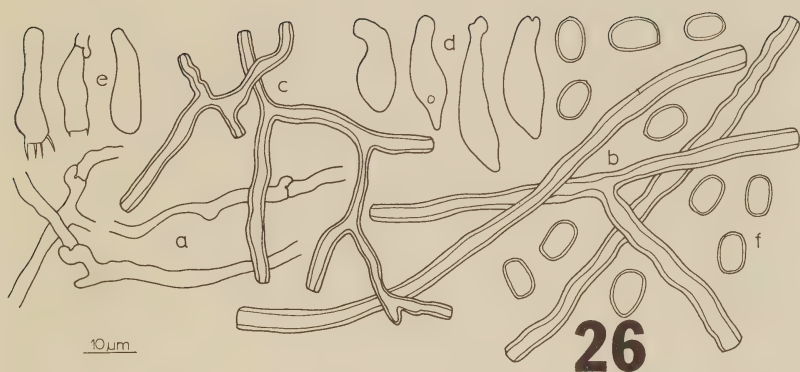


Fig. 26. *Perenniporia medulla-panis*. (JPL 1059). a) generative hyphae; b) skeletal hyphae; c) binding hyphae; d) fusoid cystidioles; e) basidia; f) basidiospores. Fig. 27. *Perenniporia tenuis*. (JPL 1065). a) generative hyphae; b) skeletal hyphae; c) binding hyphae; d) fusoid cystidioles; e) basidia; f) basidiospores.

GYMNOPIIUS SAPINEUS (Fr.) Maire, Publ. Junta Cienc. Nat.
Barcelona 15(2):96. 1933.

Basidiocarps centrally stipitate, often solitary; pileus up to 2 cm diam, concentrically wrinkled, with fine hairs, rust-colored (5YR 5/10 to 5YR 4/8), lighter toward the margin, often with a shallow umbo; lamellae attached, (near 5YR 6/10), annulus lacking. *Hyphal system* monomitic; tramal hyphae thin-walled, often inflated, many with obscured clamps, 3-13.5 μ m diam. *Pleurocystidia* slightly ventricose, some capitate, 23-26 x 6-6.5 μ m. *Cheilocystidia* similar to pleurocystidia in shape, 21-25 x 4.5-5 μ m. *Basidia* clavate, 4-sterigmate, with a basal clamp, 23-28.5 x 6.5-7.5 μ m. *Basidiospores* yellowish, dextrinoid in Melzer's reagent, verrucose, with a large central guttule, ellipsoid to broadly fusiform, with a conspicuous blunt apiculus, 6.5-9 x 4.5-6 μ m. *Voucher specimen* - JPL 1086.

LENTINELLUS COCHLEATUS (Fr.) Karst., Bidr. Kann. Finl.
Nat. Folk 32:247. 1897.

Basidiocarps stipitate, the stipe central to eccentric, solitary or fascicled, fluted or ridged; pileus surface pinkish-buff, smooth, near 10YR 7/4, margin slightly incurved, darkening to an umber brown (10YR 2/2); lamellae concolorous with pileus, serrated on edge. *Hyphal system* monomitic; tramal hyphae thin-walled, nodose-septate, 2.5-5 μ m diam; gloeoplerous tramal hyphae aseptate, with oily contents, 2.5-5.5 μ m diam. *Pleurocystidia* not seen. *Chlamydospores* present on upper part of stipe, 2-celled, pigmented, the upper cell globose and larger and darker than the lower, 13-14 x 10.5-12.5 μ m. *Basidia* clavate, 4-sterigmate, with a basal clamp, 22-25 x 5-6.5 μ m. *Basidiospores* hyaline, minutely echinulate, amyloid in Melzer's reagent, ovoid to ellipsoid, 5-6 x 3.5-4.5 μ m. *Voucher specimen* - JPL 1119.

PANUS RUDIS Fr., Epicrisis, p. 398. 1838.

Basidiocarps annual, tough, developing on slash with bark, eccentrically stipitate, pale buff (10YR 6/8); pileus hirsute, infundibuliform, with inrolled margin; lamellae crowded, wavy, decurrent; stipe up to 1.5 cm long, concolorous with pileus, hirsute, slightly swollen at the base; spore print white. *Hyphal system* dimitic; tramal generative hyphae thin-walled, nodose-septate, 2-4 μ m diam; contextual and tramal skeletal hyphae thick-walled, aseptate, 3-5 μ m diam; hyphae composing the pileus hairs



Fig. 28. *Gymnopilus sapineus*. (JPL 1086).

a) inflated tramal hyphae; b) pleurocystidia;
c) cheilocystidia; d) basidia; e) basidiospores.

slightly thick-walled, nodose-septate, 4-5 μm diam. *Pleurocystidia* of two types; one type thin-walled, cylindric and tapering slightly at the tip, projecting up to 15 μm , with a basal clamp, 34-52 x 4.5-6 μm ; another type thick-walled with the wall expanding to create a thin-walled apex, clavate (some slightly swollen in the middle), with a basal clamp, 51-60 x 8-12 μm . *Basidia* clavate, 4-sterigmate, with a basal clamp, 19-25 x 3-5 μm . *Basidiospores* hyaline, smooth, negative in Melzer's reagent, short-cylindric, slightly curved, 3.5-5 x 2 μm . *Voucher specimen* - JPL 1127.

Discussion

Thirty species of wood-rotting fungi occurring on Gambel oak are illustrated and briefly described in this paper. These fungi represent four orders in the class

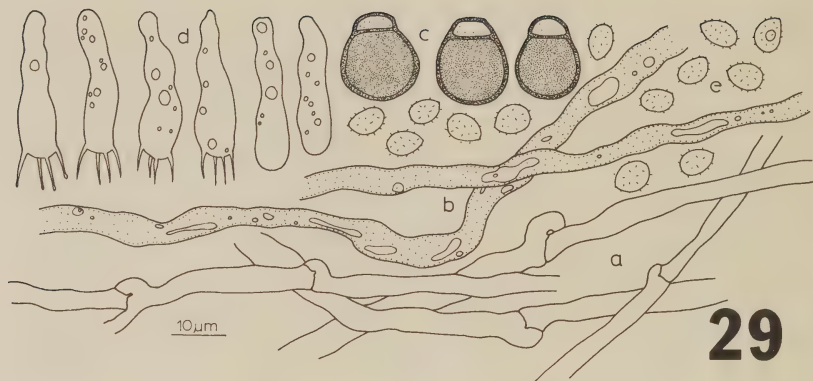


Fig. 29. *Lentinellus cochleatus*. (JPL 1119).
 a) tramal hyphae; b) gloeoplerous hyphae;
 c) chlamydospores; d) basidia; e) basidiospores.

Hymenomycetes: Tremellales, Dacrymycetales, Aphyllophorales, and Agaricales.

Several comments are worth mentioning based on these initial collections from Gambel oak. Most interesting is that no brown-rot fungi were collected; all are white-rotters. In southwestern Colorado Gambel oak grows in pure stands, as an understory in ponderosa pine and/or aspen, and less frequently with other species. All these associated species harbor brown-rot fungi. This situation could be due to the peculiar extractives, (e.g., tannins), of Gambel oak wood. Certainly brown-rot fungi should occur on Gambel oak in Colorado. Gilbertson et al. (1974) include brown-rot fungi in their list of Gambel oak fungi in Arizona. Shaw (1973) lists several brown-rotters on Garry oak (*Quercus garryana* Dougl. ex Hook.) in the Pacific Northwest, and Garry oak is thought to be a closely related species (Christensen, 1949). However, it seems apparent that brown-rot fungi are fairly uncommon on Gambel oak. It is interesting that *Gloeophyllum saepiarium* (Wolf.:Fr.) Karst., which grows on conifers and aspen, has not yet been collected on Gambel oak.

Because of the extensive eradication efforts, including periodic burning and foliar spraying with 2-4-5 T,

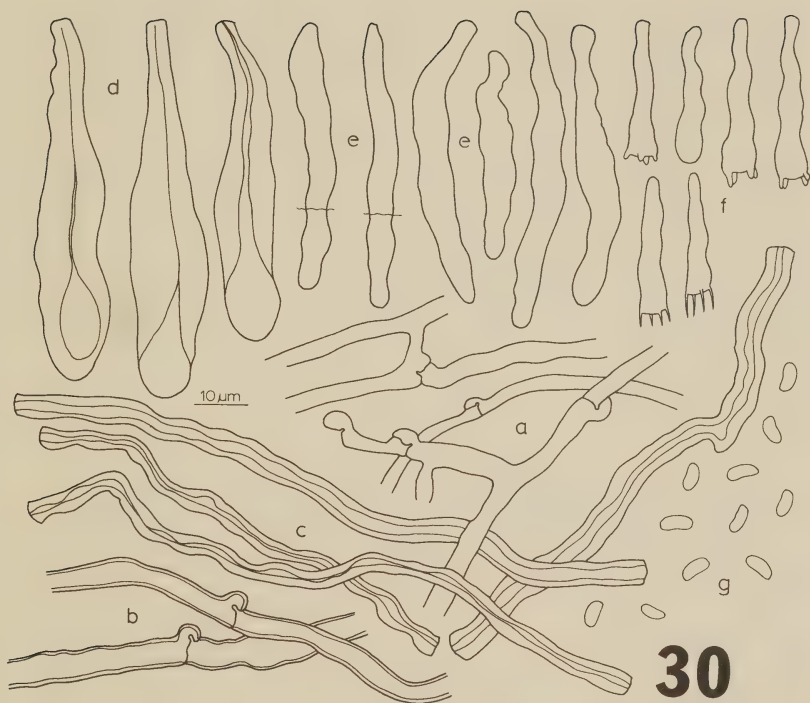


Fig. 30. *Panus rudis*. (JPL 1127). a) tramal generative hyphae; b) hyphae from pileus hairs; c) skeletal hyphae; d) thick-walled pleurocystidia; e) thin-walled pleurocystidia; f) basidia; g) basidiospores.

that have been practiced on Gambel oak in southwestern Colorado, it is possible that certain habitats have been created, or at least made more numerous, than would have been the case under natural situations. The fungi collected on the standing dead wood and charred remains of

burned trees may reflect these habitats, thus giving an altered picture of the "normal" Gambel oak mycota.

Calopactis singularis H. and P. Sydow is the anamorph of *Endothia singularis* (Syd.) Shear and N.E. Stevens and is very common in at least one of the sites collected in this study. *C. singularis* girdles branches and sometimes entire trunks of small oaks, leaving standing, dead snags, or these branches are killed by some other means, such as freezing, and *C. singularis* then invades the dead tissues. These snags subsequently serve as substrates for many slash-rotting fungi, including *Exidia glandulosa* Fr. and various species of *Hyphodontia*. *Inonotus andersonii* (Ell. et Ev.) Černý probably also serves this role as well as providing a site for cavity-nesting birds to drill holes for nests. It is possible that *C. singularis* and *I. andersonii* also are important in breaking out the tops in rather small diameter oaks, thus keeping the oak type in a shrub formation. This would explain the infrequency of large Gambel oaks in this area. Climate and weather patterns undoubtedly also play a role in the stature of these oak stands.

Acknowledgements - Thanks are extended to Dr. R.L. Gilbertson for critically reviewing the manuscript and making helpful suggestions and corrections. Dr. M.E. Barr Bigelow graciously confirmed identification of *Calopactis singularis*. Mrs. Donna Giersch typed the final manuscript.

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SOME NEW COMBINATIONS IN THE POLYPORACEAE

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SUMMARY

In connection with the flora "Polyporaceae of North America" there are proposed 5 new combinations in Antrodia, 1 in Ceriporia, 4 in Ceriporiopsis, 1 in Datronia, 4 in Diplomitoporus 1 in Earliella, 2 in Fomitopsis, 1 in Gloeoporus, 22 in Oligoporus and 2 in Perenniporia.

During the preparation of a flora of all polypores reported in North America north of Mexico, several species were found to be misplaced in the genera in which they were originally described. The main reason is that modern taxonomy in this group of fungi places the main emphasis on microscopical characters while macromorphology in most cases plays a secondary role. Instead of making the necessary transfers in the flora, where they easily may be missed, we found it more convenient to publish them in a journal of mycological taxonomy. Thus, the following combinations are proposed:

ANTRODIA ALPINA (Litsch.) Gilbn. & Ryv. comb. nov.

Basionym: Poria alpina Litsch. Oester. Bot. Zeitschr. 88: 143, 1939.

ANTRODIA FEROX (Long & Baxt.) Gilbn. & Ryv. comb.

nov. Basionym: Poria ferox Long & Baxt. Mich. Acad. Sci. Arts. Let. Pap. 25: 149, 1940.

ANTRODIA ODORA (Peck ex Sacc.) Gilbn. & Ryv. comb.

nov. Basionym: Poria odora Peck ex Sacc. Syll. Fung. 6:294, 1888. Polyporus odorus Peck 1885 is invalid as a homonym of P. odorus Fr. 1821.

ANTRODIA RADICULOSA (Peck) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus radiculosus Peck N.Y. State Mus. Ann.

Rep. 40:52, 1887.

ANTRODIA SITCHENSIS (Baxt.) Gilbn. & Ryv. comb. nov.

Basionym: Poria sitchensis Baxt. Mich. Acad. Sci. Arts.

Let. Pap. 23: 293, 1938.

CERIPORIA SPISSA (Schw.) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus spissus Schw. in Fries. Elench. Fung. 1: 111, 1828.

CERIPORIOPSIS CARNEGIEA (Baxt.) Gilbn. & Ryv. comb.

nov. Basionym: Poria carnegiea Baxt. Mich. Acad. Sci. Art.

Let. Pap. 16: 110, 1941.

CERIPORIOPSIS MUCIDA (Pers: Fr.) Gilbn. & Ryv. comb.

nov. Basionym: Polyporus mucidus Pers: Fr. Syst. Mycol. 1: 382, 1821.

CERIPORIOPSIS PANNOCINCTA (Rom.) Gilbn. & Ryv. comb.

nov. Basionym: Polyporus pannocinctus Rom. Arkiv f. Bot. 11(3):20, 1912.

CERIPORIOPSIS SUBVERMISPORA (Pil.) Gilbn. & Ryv.

comb. nov. Basionym: Poria subvermisporea Pil. Stud. Bot.

Cech. 3: 2, 1940.

DATRONIA SCUTELLATA (Schw.) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus scutellatus Schw. Trans. Am. Phil.

Soc. II, 4: 157, 1832.

DIPLOMITOPORUS LENIS (Karst.) Gilbn. & Ryv. comb.

nov. Basionym: Physisporus lenis Karst. in Rabenh. Fungi Europ. & Extraeur. Exsic. 3527, 1886.

DIPLOMITOPORUS LINDBLADII (Berk.) Gilbn. & Ryv. comb.

nov. Basionym: Polyporus lindbladii Berk. Grevillea 1: 54, 1872.

DIPLOMITOPORUS OVERHOLTSII (Pil.) Gilb. & Ryv. comb.

nov. Basionym: Poria overholtsii (Pil. Stud. Bot. Cech. 3: 2, 1940.

DIPLOMITOPORUS RIMOSUS (Murr.) Gilbn. & Ryv. comb.

nov. Basionym: Poria rimosa Murr. Mycologia 12: 91, 1920.

EARLIELLA SCABROSA (Pers.) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus scabrosus Pers. in Gaudich. Voy. aut. Monde, p. 172, 1826.

FOMITOPSIS PALUSTRIS (Berk. & Curt.) Gilbn. & Ryv.

comb. nov. Basionym: Polyporus palustris Berk. & Curt.

Grevillea 1: 51, 1872.

FOMITOPSIS SPRAGUEI (Berk. & Curt.) Gilbn. & Ryv.

comb. nov. Basionym: Polyporus spraguei Berk. & Curt.

Grevillea 1: 50, 1872.

GLOEOPORUS TAXICOLA (Pers: Fr.) Gilbn. & Ryv. comb.

nov. Basionym: Xylomyzon taxicola Pers: Fr. Elench. Fung. 1: 62, 1828.

OLIGOPORUS AMARUS (Hedgc.) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus amarus Hedgc. Mycologia 2: 155, 1910.

OLIGOPORUS ANGULOPORUS (Larsen & Lomb.) Gilbn. & Ryv.

comb. nov. Basionym: Fibroporia anguloporia Lars. & Lomb. Mycologia 75: 624, 1983.

OLIGOPORUS BALSAMEUS (Peck) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus balsameus Peck N.Y. St. Mus. Ann. Rep. 30: 46, 1878.

OLIGOPORUS CAESIUS (Fr.) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus caesius Fr. Syst. Mycol. 1: 360, 1821.

OLIGOPORUS CERIFLUUS (Berk. & Curt.) Gilbn. & Ryv.

comb. nov. Basionym: Polyporus cerifluus Berk. & Curt.

Grevillea 1:50, 1872.

OLIGOPORUS FLORIFORMIS (Quél.) Gilbn. & Ryv. comb.

nov. Basionym: Polyporus floriformis Quél. Fungi Trid. 1:

61, 1884.

OLIGOPORUS FRAGILIS (Fr.) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus fragilis Fr. Elench. Fung. 1: 86, 1828.

OLIGOPORUS GUTTULATUS (Peck) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus guttulatus Peck in Sacc. Syll. Fung. 6:

106, 1888.

OLIGOPORUS HIBERNICUS (Berk. & Br.) Gilbn. & Ryv.

comb. nov. Basionym: Polyporus hibernicus Berk. & Br. Ann.

Mag. Nat. Hist. Ser. 4, vol 7: 428, 1871.

OLIGOPORUS JOHNSTONII (Murr.) Gilb. & Ryv. comb. nov.

Basionym: Poria johnstonii Murr. Mycologia 12: 303, 1920.

OLIGOPORUS LACTEUS (Fr.) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus lacteus Fr. Syst. Mycol 1: 359, 1821.

OLIGOPORUS LEUCOMALLELLUS (Murr.) Gilbn. & Ryv. comb.

nov. Basionym: Tyromyces leucomallellus Murr. Torr. Bot.

Cl. Bull. 67: 63, 1940.

OLIGOPORUS LEUCOSPONGIA (Cooke & Harkness) Gilbn. &

Ryv. comb. nov. Basionym: Polyporus leucospongia Cooke &

Harkness, Grevillea 11: 106, 1883.

OLIGOPORUS LOWEI (Pil.) Gilbn. & Ryv. comb. nov.

Basionym: Leptoporus lowei Pil. Sborn. Nat. Mus. Praha 9B,

2: 101, 1953.

OLIGOPORUS MAPPUS (Overh. & Lowe) Gilbn. & Ryv. comb.

nov. Basionym: Poria mappa Overh. & Lowe, Mycologia 38: 210,

1946.

OLIGOPORUS OBDUCTUS (Berk.) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus obductus Berk. Lond. J. Bot. 4: 304,

1845.

OLIGOPORUS PERDELICATUS (Murr.) Gilbn. & Ryv. comb.

nov. Basionym: Tyromyces perdelicatus Murr. Mycologia 4: 95,

1912.

OLIGOPORUS PLACENTUS (Fr.) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus placentus Fr. Öfers. K. Vet. Ak. Förh.

p. 30, 1861.

OLIGOPORUS RANCIDUS (Bres.) Gilbn. & Ryv. comb. nov.

Basionym: Poria rancida Bres. Fungi Trid. 2: 96, 1900.

OLIGOPORUS SEQUOIAE (Bonar) Gilbn. & Ryv. comb. nov.

Basionym: Poria sequoiae Bonar J. Forestry 29: 377, 1931.

OLIGOPORUS TEPHROLEUCUS (Fr.) Gilbn. & Ryv. comb.

nov. Basionym: Polyporus tephroleucus Fr. Syst. Mycol. 1:

360, 1821.

OLIGOPORUS UNDOSUS (Peck) Gilbn. & Ryv. comb. nov.

Basionym: Polyporus undosus Peck, N.& St. Mus. Ann. Rep.

34: 42, 1881.

PERENNIPORIA ELLISIANA (Ander.) Gilbn. & Ryv. comb.

nov. Basionym: Fomes ellisianus Ander. Bot. Gaz. 16: 113,

1891.

PERENNIPORIA FISSILIFORMIS (Pil.) Gilbn. & Ryv. comb.

nov. Basionym: Poria fissiliformis Pil. Stud. Bot. Cech. 3:

1, 1940.

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NEW TAXA OF HYPOXYLON

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ABSTRACT

Hypoxyton dumontii sp. nov. is described from Brazilian collections. It produces a Nodulisporium anamorph and perithecial stromata in culture. Hypoxyton chestersii var. microsporum var. nov. is described from Brazilian collections. It produces a Geniculosporium anamorph in culture. The typical variety of this fungus is known only from the British Isles. Hypoxyton aeruginosum var. macrosporum var. nov. is described from Louisiana, USA. The typical variety is known only from British Guiana and Amazonian Brazil.

1. Hypoxyton dumontii J. D. Rogers & G. J. Samuels, sp. nov. Figs. 1-4, 11 and 12

Stromata pulvinata, 0.5-5 mm X 0.5-5 mm X 0.5-1 mm crassa, extus luteola vel ferruginea; proxime sub superficie aurantiaca, sub peritheciis nigra. Stromata mollia. Perithecia 0.2 mm diametro, forma perithecorum manifesta in stromatibus. Ostiola umbilicata. Asci octospori, cylindrici, longe stipitati, 110-150 μ m longitudine tota X

7-11 μm crassi, annulo apicali in liquore iodata Melzeri immerso cyanescente, triangulari in sectione opticali, 2-3 μm alto X 4-5 μm lato. Ascosporae brunneae, ellipsoideo-inaequilaterales vel rectangulares, leves, (11-)13-16(-20) X 6-8 μm , rimae germinativae longitudo minor quam sporae integrae. Status anamorphosis Nodulisporium.

Stromata pulvinate, 0.5-5 mm X 0.5-5 mm X 0.5-1 mm thick, externally yellowish to rusty red; orange immediately beneath surface and black beneath perithecia. Stromata soft. Perithecia 0.2 mm diam, the contours evident on stroma (Fig. 1). Ostioles umbilicate. Asci eight-spored, cylindrical, with long stipes, 110-150 μm total length X 7-11 μm broad. Ascus apical ring bluing in Melzer's iodine reagent, triangular in optical section (Fig. 3), 2-3 μm high X 4-5 μm wide. Ascospores brown, ellipsoid-inequilateral to rectangular, smooth, (11-)13-16(-20) X 6-8 μm , with germ slit less than spore-length (Figs. 2,4). Anamorph a Nodulisporium.

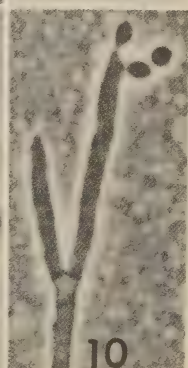
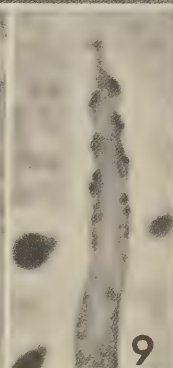
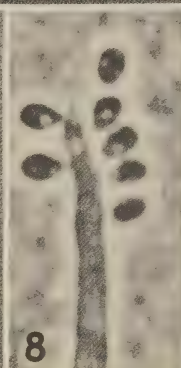
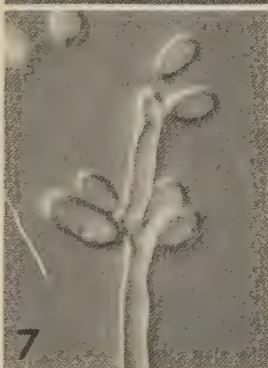
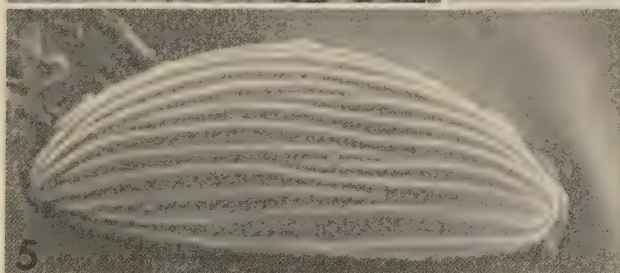
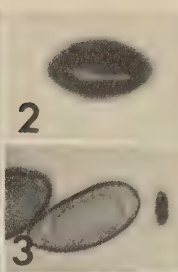
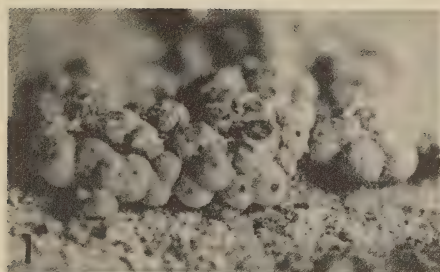
Colonies on 2% oatmeal agar incubated at ca. 22 C in natural daylight/darkness covering 9 cm Petri plate in 2-3 wk, with areas of aerial mycelium and compact appressed mycelium, sulfur yellow with rings or irregular sectors of orange brown. Reverse blackish. Perithecial stromata formed abundantly in orange brown areas, closely resem-

Figs. 1-12. Hypoxylon dumontii and Hypoxylon chestersii var. microsporum. 1-4. H. dumontii. 1. Perithecial stromata on host, X 15. 2. Ascospore, partially out of focus to show germ slit, X 1100. 3. Ascus tip stained by iodine, X 1100. 4. Ascospores, X 1100. 5-10. H. chestersii var. microsporum. 5. Ascospore, X 6000. 6. Ascospore, X 2500. 7. Conidiophore with conidia, X 2000. 8. Conidiophore showing arrangement of conidia on conidiogenous region, X 2000. 9. Conidiophore showing geniculated conidiogenous region and tapered apex, X 2500. 10. Branched conidiophore, X 1000. 11-12. H. dumontii. 11. Conidia, X 1200. 12. Conidiophores, X 800.

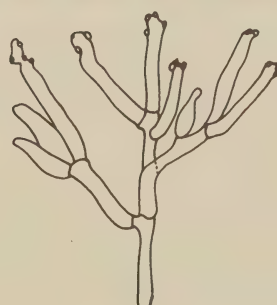
Fig. 1 by macrophotography. Figs. 2-4, 6 by bright-field microscopy. Fig. 5 by scanning electron microscopy. Fig. 7 by differential interference microscopy. Figs. 8-10 by darkfield phase microscopy. Figs. 11 and 12 drawn from brightfield microscopy.

Figs. 1-4, 11 and 12 from DU-BR 1009. Figs. 5-7 from DU-BR 828. Figs. 8-10 from Samuels 391. See text for complete citations for collections.

All magnifications approximate.



11



12

bling those produced under natural conditions.

Conidiophores arising from areas of appressed mycelium, sparingly branched, 65-80 μm long, subhyaline to brownish, smooth to minutely spinulose in older regions (Fig. 12). Conidiogenous regions producing conidia holoblastically, the terminal parts swollen from repeated conidial production (Fig. 12). Conidia hyaline, smooth, obovoid to ellipsoid, with flattened scars indicating their former points of attachment to the conidiogenous cell (Fig. 11), 3.5-4(-5) $\times$ 2-3 μm .

Named in honor of our friend, K. P. Dumont, a member of the expedition during which the type collection was made.

COLLECTIONS EXAMINED: BRAZIL: Samuels, G. J., et al., DU-BR 1009, 14.XII.1977, shore of Rio Negro, Igapó, Estado de Amazonas, on dead monocot (INPA 122215, HOLOTYPE; NY, ISOTYPE); Samuels, G. J., nos. 26 and 29, 31.I.1984, Perimetral Norte highway, 45 km W of Caracarai Fazenda Repartimento, Igarapé Repartimento do Ajaraní, Território de Roraima, no. 26 on dicot bark, no. 29 on monocot stem (INPA; NY; J. D. Rogers herb.).

Hypoxylon dumontii is the only member of section *Hypoxylon* (Miller, 1961) which is known to produce fertile ascomata in culture. Its *Nodulisporium* anamorph is similar to those reported for some other species in section *Hypoxylon* (see Jong & Rogers, 1972). Unfortunately, our cultures of this fungus are no longer viable. The fungus resembles *Hypoxylon notatum* Berk. & Curt. in general morphology, but is more brightly colored. Moreover, *H. notatum* occurs chiefly on *Quercus* in USA (Miller, 1961) and, to our knowledge, has not been reported outside of the USA. *Hypoxylon dumontii*, on the other hand, is currently known only from Amazonian Brazil. Two of the three known collections are from monocot stems. Thus, although it is probable that *H. notatum* and *H. dumontii* are related we consider them to be separate and distinctive species.

2. *Hypoxylon chestersii* J. D. Rogers & A. J. S. Whalley
var. microsporum J. D. Rogers & G. J. Samuels, var. nov.
Figs. 5-10

A varietate typica differt in ascosporis 11.5-14 $\times$ 4.5-6 μm .

Differs from the typical variety in the size of ascospores, 11.5-14 $\times$ 4.5-6 μm (Figs. 5 and 6). Anamorph a Geniculosporium.

Colonies on SME (see Kenerley & Rogers, 1976) incubated at ca. 22 C in natural daylight/darkness covering 9 cm Petri plate in 1 month, with mycelium appressed, whitish to pale tan. Reverse pale yellow.

Conidiophores produced at periphery of plate, sparingly branched, subhyaline, smooth, 35-95 X 3-3.5 μ m long. Conidiogenous regions geniculated and bearing conspicuous conidial secession scars (Figs. 7-10), apical, usually conspicuously tapering, or becoming intercalary by interruption of sporulating regions by nonsporulating segments (Figs. 7-9). Conidia produced holoblastically. Conidia hyaline, smooth, obovoid, with flattened bases indicating former points of attachment to the conidiogenous cell (Figs. 7-10), 3-5 X 1.5-3 μ m.

COLLECTIONS EXAMINED: BRAZIL: Dumont, K. P., BR 828, 11.XII.1977, Boca da Mata, Territorio de Roraima, on dicot wood (INPA 93340, HOLOTYPE; NY, ISOTYPE and dried cultures with anamorph; J. D. Rogers herb., ISOTYPE and dried cultures with anamorph); Samuels, G. J., no. 391, 19.II.1984, south side of northern massif, Plateau of Serra Aracá, Estado de Amazonas, on bark and old polypore (INPA; NY; J. D. Rogers herb.).

It is most interesting to discover a variety of Hypoxyton chestersii from tropical South America. The typical variety is known only from the British Isles (Rogers & Whalley, 1978). The teleomorph of var. microsporum seems very similar to the typical variety, differing primarily from the latter in having smaller ascospores on average. The ascospore ridges of var. microsporum (Figs. 5 and 6) seem identical to those of the typical variety. The anamorphs of var. microsporum and the typical variety are referable to Geniculosporium. Chesters & Greenhalgh, the new variety separable from the typical variety primarily on the smaller average size of its conidia (Whalley & Rogers, 1980).

Hypoxyton chestersii is the second Hypoxyton with distinctly ornamented ascospores known to have varieties on different continental land masses. Hypoxyton weldenii J. D. Rogers which was described from Louisiana, USA has a small-spored counterpart, H. weldenii var. microsporum J. D. Rogers, which was described from Honduras (Rogers, 1977; 1980).

3. Hypoxyton aeruginosum J. H. Miller var. macrosporum J. D. Rogers.

A varietate typica differt in ascosporis 11-14 X 5-7 μm .

Differs from the typical variety in the size of ascospores, 11-14 X 5-7 μm .

COLLECTION EXAMINED: USA: Lowy, B., 19.I.1957, Zemmurray estate, Tickfaw, Tangipahoa Parish, Louisiana, on bark (WSP 67594, HOLOTYPE).

Hypoxylon aeruginosum was until recently known only from the type collection from British Guiana. Recently, we examined a second collection of the typical variety: BRAZIL: Samuels, G. J., no. 902, 28.II.1984, base of west slope of Serra Aracá, Estado de Amazonas, on wood (INPA; NY; J. D. Rogers herb.). Attempts to obtain cultures failed.

Hypoxylon aeruginosum var. macrosporum seems identical to the typical variety in its distinctive blue-green color and general morphology (see Miller, 1961). It appears to differ from the typical variety principally in the larger size of the ascospores.

ADDITIONAL COMMENTS

It is perhaps noteworthy that in the cases of H. chestersii and H. aeruginosum as well as H. weldenii, the small-spored subtaxa have been described from tropical regions whereas the large-spored subtaxa have been described from more temperate localities (Miller, 1961; Rogers, 1977, 1980; Rogers & Whalley, 1978). This might indicate that, for a given taxon, larger spores are advantageous in cooler, or seasonally cool, environments and are selectively favored. Any advantage of larger spores probably involves a greater capacity to store substrates for eventual germination over cool or cold periods.

Perusal of Miller's monograph (1961) does not necessarily support a trend toward small-spored subtaxa in the tropics. However, some of Miller's subtaxa are probably, in reality, separate species. The subtaxa that we cite herein are almost certainly varietal pairs. It must be noted contrariwise, however, that some of the xylariaceous fungi with the largest ascospores known in the family are tropical. Unfortunately, most of these do not have temperate counterparts that can be investigated.

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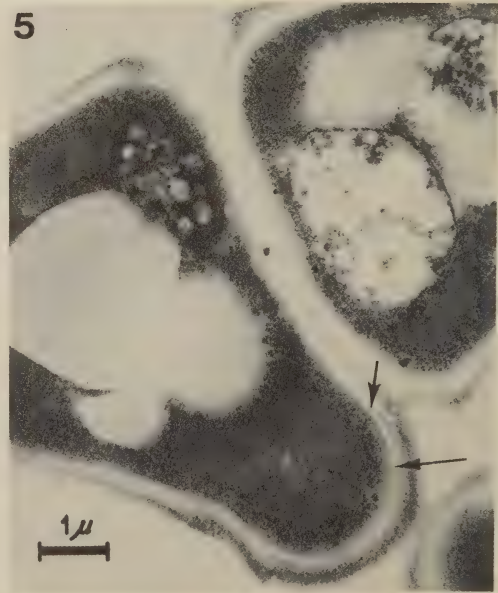
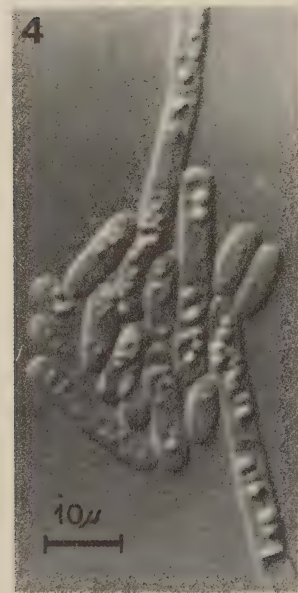
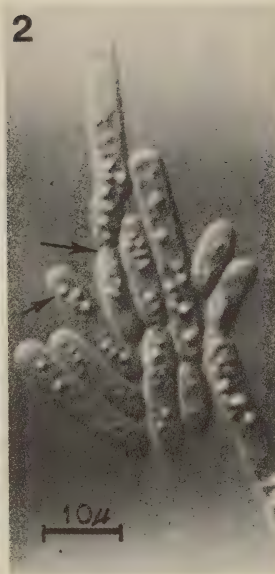
BLASTOSCHIZOMYCES CAPITATUS, A NEW COMBINATION

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INTRODUCTION

Blastoschizomyces pseudotrichosporon Salkin, Gordon, Samsonoff et Rieder was recently established to accommodate blastomycetes which form annelloconidia either along the hyphae, at the ends of branches, or both (Salkin, Gordon, Samsonoff, and Rieder, 1982). The conidia subsequently undergo schizolytic division and then blastoconidia formation, resulting in clumps of cells which resemble arthroconidia. Although *B. pseudotrichosporon* shared many physiologic and morphologic traits with *Trichosporon capitatum* Diddens and Lodder (Salkin et al., 1982), the formation by the former of annelloconidia, as contrasted with the reported and observed arthroconidia developed by the latter, was considered of sufficient importance to warrant the establishment of *B. pseudotrichosporon* as a new genus and species. Subsequent photomicroscopic cinematographic study of conidiogenesis in several isolates of *B. pseudotrichosporon* and the isolate designated as the "type" culture of *T. capitatum* by the Centraalbureau voor Schimmelcultures (CBS; CBS 2364) have caused us to reevaluate the taxonomy of these two organisms. We have concluded that the two taxa are conspecific and therefore that the new combination *B. capitatus* Salkin, Gordon, Samsonoff et Rieder is necessary.



MATERIALS AND METHODS

Test organisms. Five *B. pseudotrichosporon* isolates (a subculture of the original isolate from which the holotype M46-67 was derived, M2518-82 isolated from sputum, M699-83 isolated from sputum, M1554-83 (NCMH) isolated from sputum, and Zurich-82 isolated from the mouth), and the isolate designated as the "type" culture of *T. capitatum* (CBS 2364) by the CBS were grown on Emmons' modified Sabouraud dextrose agar slants at 27C and transferred at monthly intervals to fresh medium. Inocula for all studies were obtained from slants incubated at 27C for 72 h.

Light and electron microscopic studies. The 6 isolates were examined by light microscopy, electron microscopy, or both. In order to afford continuous observation of the development of individual annellides and to provide the thin agar cultures required for electron microscopy, isolates were grown in a Coleman perfusion chamber as described previously (Salkin et al., 1982). A portion of growth from a 72-h culture was lightly cut into the surface of cornmeal agar supplemented with 1% Tween 80 coated on the lower half of the chamber. A sterile round 18-mm coverslip was then placed on the surface of the agar, and the entire chamber was assembled aseptically. Development was followed with a Nikon Photophot microscope equipped with Hoffman modulation contrast optics. Samples for electron microscopy were prepared as described by Salkin et al. (1982). Agar disks from the

Figs. 1-4. Time-lapse cinematography of annelloconidiogenesis. Fig. 1. Phase-contrast micrograph of an annelloconidium of *B. capitatus* (arrow) developing from a conidiogenous cell (arrow). Fig. 2. Annelloconidium illustrated in Fig. 1 has been pushed aside (arrow) as new annelloconidium (arrow) forms from the same annellide. Fig. 3. As a new annelloconidium (arrow) is forming from tip of the conidiogenous cell, the annelloconidium noted in Fig. 2 (arrow) has been moved aside. Fig. 4. Later stage in conidiogenesis demonstrating a clump of annelloconidia which superficially resembles a group of arthroconidia. Fig. 5. High-voltage transmission electron photomicrograph illustrating conidiogenous cell with developing conidium (arrow) and annellations (arrows).

perfusion chamber were dehydrated, flat-embedded in Epon-Araldite, serially thick (0.25- μ m)-sectioned, collected on Formvar-coated grids, stained with 2.5% aqueous uranyl acetate and lead citrate, and then examined in an AEI EM7 MK II 10 high-voltage electron microscope operated at 800 Kv with an objective aperture of 20 μ m.

TAXONOMY AND DISCUSSION

Blastoschizomyces capitatus (Diddens & Lodder) Salkin, Gordon, Samsonoff et Rieder, comb nov.

$\equiv$ *Trichosporon capitatum* Diddens & Lodder 1942, Die anaskosporogenen Hefen II, p. 488.

$\equiv$ *Geotrichum capitatum* (Diddens & Lodder) v. Arx 1977, Stud. Mycol. 14, p. 32.

= *Blastoschizomyces pseudotrichosporon* Salkin, Gordon, Samsonoff et Rieder 1982, Mycotaxon 14, 500.

Neotype: JHH 3699, New York State Herbarium, Albany, New York.

A permanently preserved specimen and lyophilized cultures were derived from CBS 2364 and deposited in the New York State Herbarium (NYS), Albany, New York as JHH 3699. CBS 2364, which was designated as the "type" culture, is maintained at the CBS as a living isolate.

When Diddens and Lodder described *T. capitatum* in 1942, they were not obligated under the then-existing code to deposit a permanently preserved type specimen. While no holotype for *T. capitatum* was designated at the time of the original description, living and lyophilized cultures have been maintained and designated by the CBS as the "type" (CBS 2364). Because a permanently preserved type is required under the present code (Voss, E.G., H.M. Burdet, W.G. Chaloner, V. Demoulin, P. Hiepko, J. McNeill, R.D. Meikle, D.H. Nicolson, R.C. Rollins, P.C. Silva, and W. Greuter, 1983; Article 9.5) for all new taxa, and since CBS 2364 was deposited by Diddens and Lodder at the time of their original description, we felt it should be used for the preparation of the type of *B. capitatus*. There-

fore, we have prepared from it a permanently preserved specimen and deposited it as the neotype in the NYS Herbarium (JHH 3699). The neotype of *B. capitatus* is needed to serve as the type for this species.

Time-lapse cinematography revealed that CBS 2364 forms annelloconidia rather than arthroconidia as the most distinctive anamorphic form (Figs. 1-4). The morphologic features of conidiogenesis are identical to those previously described for *B. pseudotrichosporon*, as well as those observed during this study. The annellides are smooth, hyaline and develop either at the apices of branches, along the growing hyphal axis, or both. The annelloconidia are smooth, oblong with truncate bases, and accumulate in clusters at the apices of the annellides. This is the most distinctive and stable anamorph produced by the fungus and serves as the basis of its identification. Diddens and Lodder (1942) mentioned a similar accumulation of conidia in their description of *T. capitatum*: "It should be noted that these typical heads consist of accumulations of cells in clusters" (translated from German). Transmission electron microscopic studies of the conidiogenous cell revealed the per-current proliferation typical of annellides (Fig. 5).

Although arthroconidia were observed in several cultures originally derived from CBS 2364, they were so few in number that we believe that they should be considered as a minor synanamorph. Since *T. capitatum* and *B. pseudotrichosporon* are essentially physiologically (Salkin et al., 1982) and morphologically identical, we consider them conspecific. Owing to priority, *B. capitatus* comb. nov. is the correct name for this blastomycete taxon rather than *B. pseudotrichosporon*.

It has been clearly demonstrated that *B. capitatus* cannot be retained in the genus *Trichosporon* because of its unique mode of conidiogenesis. Therefore, we do not agree with the continued placement of this taxon in *Trichosporon* as in the recent study by Kreger-van Rij, 1984. Judging from the description of *B. capitatus* (as *T. capitatum*) provided in this work, Kreger-van Rij was apparently unaware of the fact that annellidic conidiogenesis in this fungus is the mostly highly differentiated, distinctive and stable form.

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HERTELLA, A NEW LICHEN GENUS IN THE PELTIGERALES FROM THE SOUTHERN HEMISPHERE

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SUMMARY

The new genus Hertella Henssen is described to include two new species, the type species Hertella subantarctica Henssen from the Prince Edward and Kerguelen Islands and Hertella chilensis Henssen from southern Chile. On the basis of the developmental morphology of the hemiangiocarpous apothecium, the genus is placed in the Peltigerales.

Hertella has a minutely filamentous thallus derived from the morphology of the phycobionts, brown or blackish apothecia surrounded by a pale excipulatory cup, amyloid octosporous asci, and unseptate colourless spores. Phycobionts are Scytonema or Tolypothrix. The hyphae extend longitudinally within or upon the gelatinous algal sheath; haustoria are formed by short side branches. The two species differ in external and internal morphology of the thallus and apothecia.

INTRODUCTION

The name Hertella is introduced for a new Southern Hemisphere lichen genus in honour of Hannes Hertel who discovered the type species, Hertella subantarctica, during a joint field trip in the Prince Edward Islands. The expedition, "S. A. Agulhas Voyage: Marion Island Relief April/May 1982", was conducted by the Research Group of the

Institute for Environmental Sciences, University of the Orange Free State, Bloemfontein, RSA.

The new lichen also has been collected by French expeditions to the Kerguelen Islands. A second species, H. chilensis, is described from southern Chile.

H. subantarctica is the second new cyanophilic lichen described from our material from the Prince Edward Islands, the first, Phyllisciella marionensis Henssen, was collected in the central part of Marion Island (Henssen & Büdel 1984). For both lichens a new genus had to be established.

According to our observations, small cyanophilic lichens are abundant at suitable sites on the islands associated with a great variety of blue-green algae. Hitherto, only four species with symbiotic blue-green algae, two of Pannaria and two of Peltigera, had been reported from the Prince Edward Islands (Lindsay 1977, Gremmen 1982).

The genus Hertella is of special interest as it combines the characteristics of a poorly lichenized, filamentous thallus with a hemiangiocarpous development of the apothecia corresponding to that in the order Peltigerales (treated as suborder Peltigerineae in Henssen et al. 1981).

METHODS

The methods described in Henssen et al. (1978) were followed. Unless stated otherwise, measurements refer to microtome sections embedded in lactopheol cotton-blue (LPCB) or to air dry material as appropriate.

TAXONOMY

Hertella Henssen gen. nov.

Thallus parvus, filamentosus, gelatinosus, olivaceus. Alga symbiotica ad Scytonema vel Tolypothrix pertinens, hyphae praecipue in gelatine algarum extensae, haustoria formantia. Apothecia hemiangiocarpa, adnata, fusca vel nigricantia cum excipulo incolorato. Asci amyloidei, octospori, sporae eseptatae, incoloratae. Pycnidia adnata, conidiophora brevi-cellularia, conidia terminalia

et lateralia formantia. Genus ad Peltigerales pertinens.

Typus generis: Hertella subantarctica Henssen

Thallus small, olive, filamentous, fastened by a gelatinous attachment base. Filaments less than 0.5 mm long, single or paired. Phycobionts species of Sytonema or Tolypothrix. Hyphae extending in parallel, in longitudinal sections seen to be mainly within the gelatinous sheath of the algal filaments, haustoria formed by short side branches.

Apothecia adnate, olive or brown, surrounded by a pale proper margin. Development of the apothecia hemiangiocarpous, ascogonia large-celled. Hymenium strongly gelatinous, staining dark blue in iodine, epithecium and hypothecium light brown. Excipulum proprium cupular, thick, pseudoparenchymatous. Paraphyses distinctly septate, sparsely branched in the upper part. Asci cylindrical to clavate, with amyloid caps or indistinct ring-structure, 8-spored. Spores simple, colourless, ellipsoid or slightly curved.

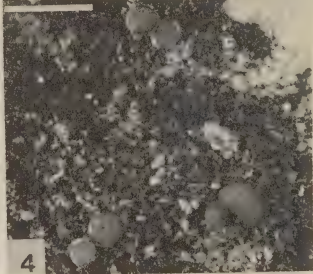
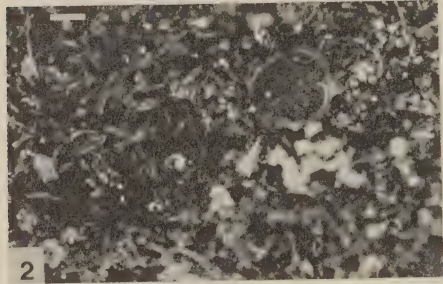
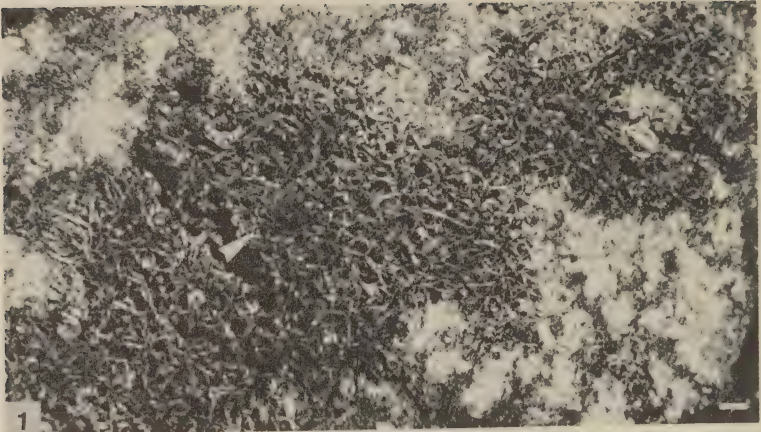
Pycnidia adnate, conidiophores with a few short cells forming rod-shaped conidia terminally and laterally.

Ecology and distribution: on shady or temporarily moist rocks in the Southern Hemisphere.

Chemistry: An unknown substance.

THALLUS. The species of Hertella are characterized by a minute filamentous thallus forming tufts or rosettes with marginally spreading lobes (Figs. 1-4). The thallus may appear almost crustaceous when the lobes are densely aggregated and glued together by associated colonies of blue-green algae.

The habit of the lobes corresponds largely to the morphology of the symbiotic algae which differ in the two lichens in the type of the false branching. The false branches of the phycobiont arise singly in H. chilensis (Figs. 8, 11) and frequently in pairs or more than two in H. subantarctica (Figs. 3, 5). The two algae differ also in the thickness of the gelatinous sheath and the position of the heterocysts. The trichomes of the symbiotic alga in H. chilensis have a rela-

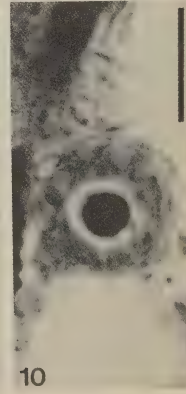
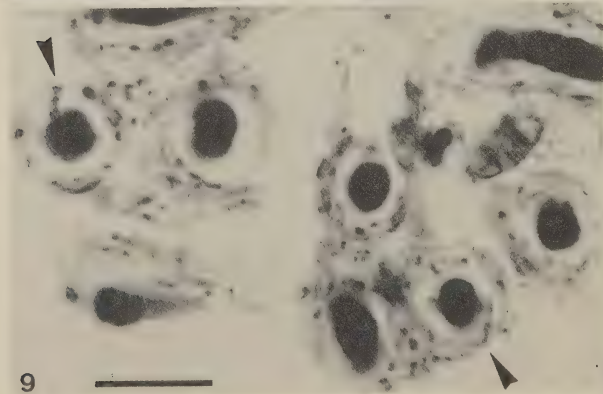
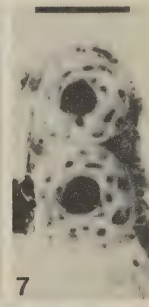
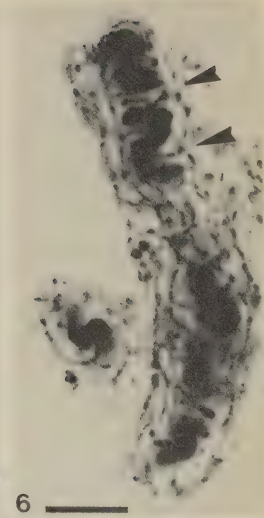
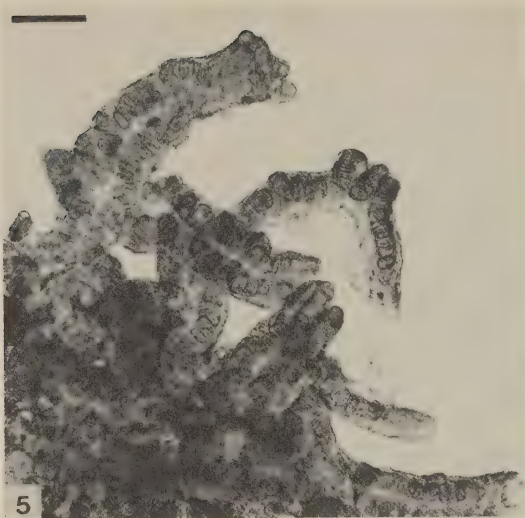


tively thin homogenous sheath and basal heterocysts, while in the phycobiont of H. subantarctica the gelatinous sheath is thicker and layered, and the heterocysts are frequently intercalary. On the basis of these characters, the phycobiont seems to be a species of Tolypothrix in H. chilensis, and one of Scytonema in H. subantarctica.

The hyphae extend parallel to one another in longitudinal sections. In H. subantarctica they are arranged mainly in several layers around the algal trichomes and are connected to each other by side branches diverging at short intervals (Figs. 6-7). In H. chilensis, one hyphal layer is usually observed which in later stages develops into an entire sheath of enlarged cells (Figs. 9-11). Haustoria form in both species from short side branches (Fig. 7, 9).

FRUCTIFICATIONS. The developmental morphology of the ascocarp corresponds to the hemiangiocarpous type of the Peltigerales (Henssen & Jahns 1973, Keuck 1977, Henssen et al. 1981). The youngest stage observed was a globose primordium of generative tissue adnate to a lobe and including relatively large ascogonial cells together with remains of trichogynes (Fig. 12). A later stage with distinctly septate paraphyses in a palisade-like layer growing into a cavity below a covering layer (Fig. 15) greatly resembles the young fruit bodies in Peltigera species, Hydrothyria venosa and Polychidium muscicola (Henssen 1963, Henssen et al. 1981). In common with the latter lichen (Henssen 1963, plate 28 b), Hertella has a well-developed pseudoparenchymatous excipulum proprium. In H. chilensis the cells of the pseudoparenchyma remain isodiametric and thin-walled (Figs. 13, 15, 17), while in H. subantarctica the cell walls become more strongly gelatinized in older

Figs 1-4. Habit photographs of Hertella species. 1-3, H. subantarctica (holotype). 1, Part of a thallus with a convex apothecium (arrow). 2, Young apothecium with a flat disc and pale proper margin (arrow). 3, Marginal part of a fertile thallus. 4, H. chilensis (holotype), part of a thallus bearing apothecia of different age. Scale 1 and 4 = 0.5 mm, 2-3 = 100 μ m.



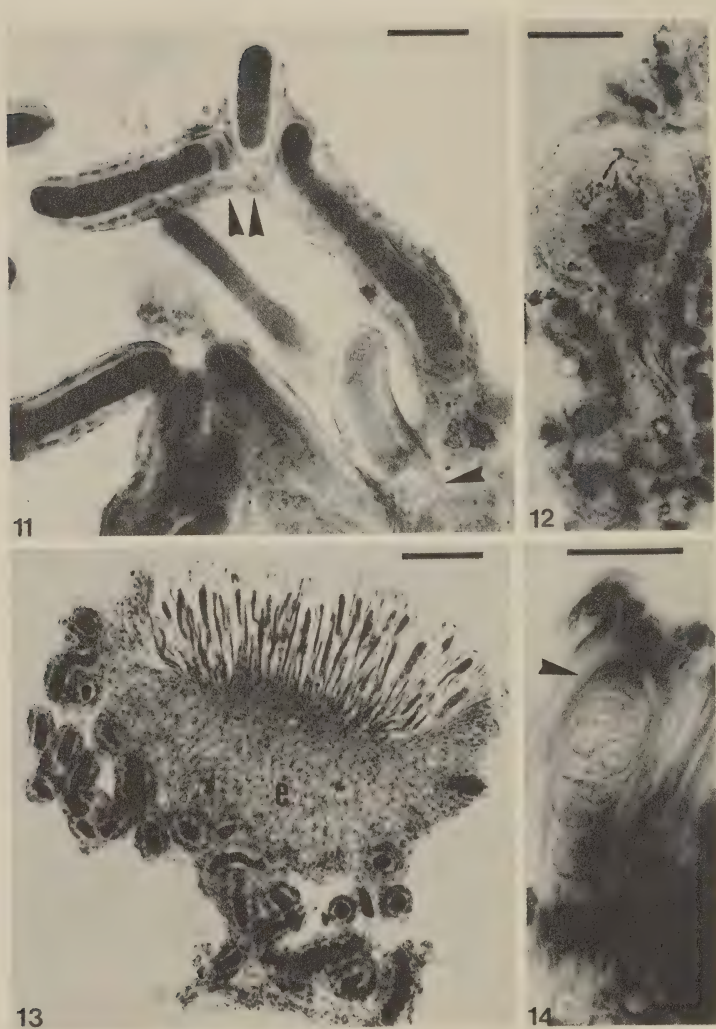
stages (Fig. 17). Hyphae develop from the marginal cells of the excipulum reinforcing the attachment of the apothecia to the adjacent lobes. When stained in iodine, amyloid caps were observed within and above the thickened ascus apex (Fig. 14) or, more rarely, as a faint ring-structure.

The small pycnidia include short-celled conidiophores composed of few, sometimes only two, conidiogenous cells (Fig. 16, arrow); these produce short rod-shaped conidia acrogenously or pleurogenously. The pycnidial cavity might be interpreted as a primitive *Umbilicaria*-type, type VI in the sense of Vobis (Vobis & Hawksworth 1981); type VI is known to occur in *Placynthium*, another genus of the Peltigerales (Henksen 1984).

SYSTEMATIC POSITION. On the basis of the developmental morphology of the hemiangiocarpous fruit body, *Hertella* has to be referred to the Peltigerales. As pointed out above, the young apothecium closely resembles that of *Polychidium muscicola* but in this lichen the ascus is provided with a clearly defined amyloid ring-structure of the *Peltigera*-type (Keuck 1977 Fig. 64) which does not occur in species of *Hertella*.

The new genus might be tentatively placed in the family Placynthiaceae sensu lato including the genera with small filamentous or squamulose

Figs 5-10. Habit and anatomy in *Hertella* species. 5-7, *H. subantarctica* (5, Delarue L 314, 6-7, holotype). 5, Lobes single or in pairs corresponding to the branching pattern of the *Scytonema* phycobiont (water preparation). 6, L.s. of lobe; longitudinally extending hyphae connected by perpendicular side branches (arrows) (LPCB). 7, T. s. of a pair of filaments (LPCB). 8-10, *H. chilensis* (holotype). 8, Lobes following the branching pattern of the filaments of *Tolypothrix* (water preparation). 9, T. s. of lobes, hyphal sheath in different stages of development, haustoria formed by side branches (arrows). 10, T.s. of algal filament surrounded by an entire sheath of enlarged hyphal cells (LPCB). Scale 5 = 50 μ m, 6-10 = 20 μ m.



Figs 11-14. Anatomy in Hertella species (11-13, microtome sections, 14, squash preparation in LPCB). 11, H. chilensis (holotype), l. s. of filaments; false branches of the Tolypothrix phycobiont starting with a basal heterocyst (arrows).

thalli. The developmental morphology and ascus structure in a number of these genera is at present too incompletely known to permit a satisfactory segregation into more natural groups.

Key to the species of Hertella

- 1 Lobes frequently in pairs; apothecia olive to blackish, rarely brown, Kerguelen and Prince Edward Islands..... H. subantarctica
- 1' Lobes always single; apothecia red-brown; Chile..... H. chilensis

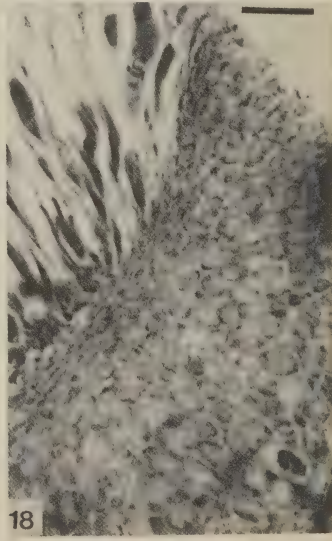
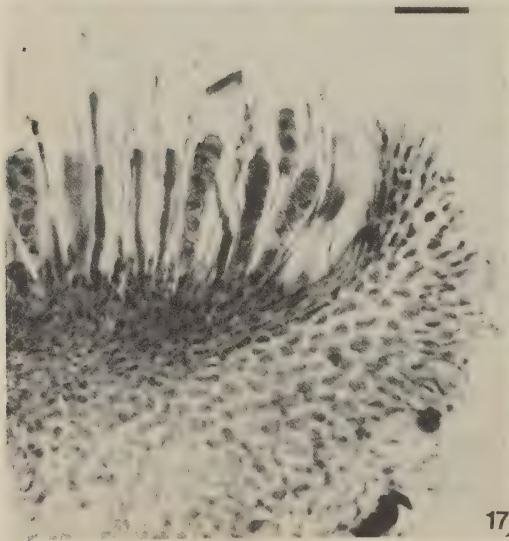
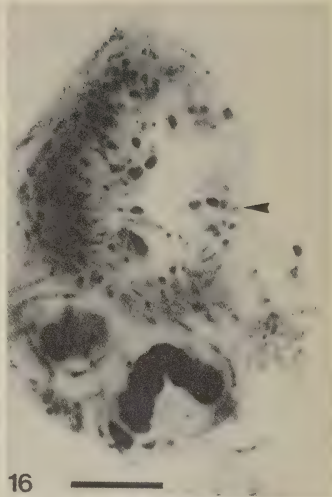
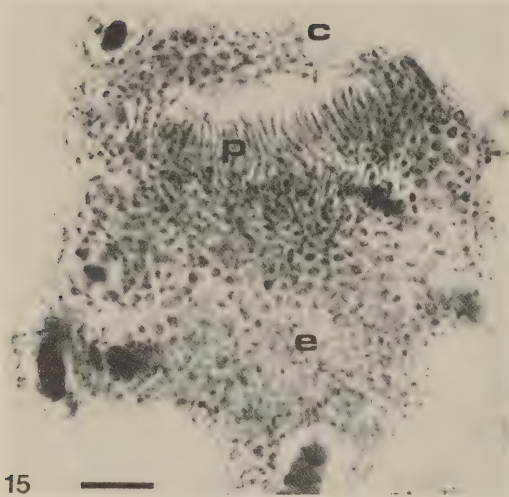
Hertella subantarctica Henssen spec. nov.

Figs. 1-3, 5-6, 12, 16, 18

DIAGNOSIS. Thallus saxicola, minutus, filamentosus, gelatinosus, olivaceus, rosulatus et 5-20 mm latus vel diffusus et saltem ad 50 mm latus, strato gelatinoso substrato affixus. Fila solitaria vel binatim, circiter 0.3-0.4 mm longa et 0.01-0.02(-0.45) mm crassa. Hyphae 1.5-2(-3) μ m crassae. Alga ad Scytonema pertinens, ramificatio saepe binatim.

Apothecia olivacea vel nigricantia, usque ad 0.3 mm lata, discus primo planus excipulo proprio pallido circumdatus, in statu vetusto discus convexus et excipulum proprium evanescens. Hymenium amyloideum, 50-75 μ m altum, excipulum proprium 40-120 μ m crassum, pseudoparenchymatum. Paraphyses 1-2 μ m latae, apicem versus sparsim ramosae et 3 μ m latae. Asci cylindraceo-clavati, 40-56 x 8-12 μ m, octospori. Sporae eseptatae, incolortae, ellipsoideae vel curvatae, 7-12 x 3.5-5(-6) μ m. Pycnidia 55-90 μ m lata, conidiophora brevicellularia, conidia terminalia et lateralialia formantia, conidia bacilliformia, circiter 3 x 1 μ m.

12, H. subantarctica (holotype), primordium of apothecium between lobes. 13, H. chilensis, l.s. of apothecium (e, cupulary excipulum). 14, H. subantarctica (holotype), ascus with amyloid caps (arrow) after staining in iodine. Scale 1 and 4 = 20 μ m, 2-3 = 50 μ m.



Figs. 15-18. Anatomy in *Hertella* species (microtome sections in LPCB). 15, *H. chilensis* (holotype), young hemiangiocarpous apothecium (c, covering layer, e, excipulum, p, paraphyses). 16-17,

Chemistry: A new depsid was identified by HPTLC-method and u.v./v.i.s. spectroscopy. In solution C the spot was assigned to Rf class 23.

Holotypus: Prince Edward Islands, Marion Island, Coastal Plain along van den Boogaard River near Rockhopper Bay, 46°52'S, 37°51'E, on vertical or inclined plates of grey lava just above water level, 1982, Henssen 28114a (MB) (isotypus: PRE; further isotypes will be distributed in Henssen, Lichenes cyanophili exsiccati).

Further specimens examined. Prince Edward Islands, Marion Island, van den Boogaard River at same locality as holotype, on vertical cliff 45 cm above water level, 1982, Hertel 24212, on boulders of grey lava at the river bank further inland between Rockhopper Bay and Tafelberg, 46°53'S, 37°49'E, 1982, Henssen 28168b (MB, PRE) and 28170a (MB, PRE).- Kerguelen Island, NW-part, Lac du Nord of the glacier Gentil, in part exposed to the waves, 25 cm above water level, 1978, Delarue L 314 (MB, REN).

Thallus small, olive, filamentous or almost crustaceous, in rosettes, rings or tufts 5-12 (-20) mm diam or diffuse and at least 50 mm broad, to 1 mm high, fastened by a gelatinous attachment base. Lobes horizontal or more or less erect, 0.3-0.4 mm long, single filaments 0.01-0.02 mm, in pairs 0.45 mm thick. Phycobiont a species of Scytonema with false branches singly, in pairs or more than two, heterocysts intercalary or basal at the base of side branches, algal trichomes 8-12 µm broad with gelatinous sheath 18-24(-30)µm (water preparations). Hyphae 1.5-2 (-3) µm thick, in 1-3 layers longitudinally extending within (rarely upon) the gelatinous sheath of the algal trichome, longitudinal hyphae connected by side branches, haustoria enlarged cells formed by short side branches.

H. subantarctica (holotype). 16, L.s. of pycnidium; conidiophore with two conidiogenous cells producing conidia acrogenously and pleurogenously, respectively (arrow). 17, Marginal part of apothecium; excipulum cells thick-walled. 18, H. chilensis (holotype), marginal part of apothecium; excipulum cells thin-walled. Scale = 20 µm.

Apothecia olive or blackish (rarely brown), to 0.3 mm broad, disc at first flat and surrounded by a pale proper margin, later becoming convex and proper margin suppressed. Hymenium 50-70(-75) μm high, hymenial gelatin olive in the upper and lower part, deep blue in iodine, subhymenium reddish brown, 25-50 μm (12-20 μm in Delarue L 314). Excipulum cupular, pale, 40-45 μm broad in the upper part, 50-120 μm (80-95 μm in Delarue L 314) at the base, pseudoparenchymatous, cells 4.5-12 μm wide, in mature apothecia with roundish lumina and thick walls. Paraphyses 1-2 μm thick, enlarged to 3 μm at the tip, simple or branched in the upper part. Asci cylindrical to clavate, 40-56 x 8-12 μm (32-47 x 7-12 in L 314) μm , 8-spored, thickened apex with amyloid caps or a faint apical ring-structure. Ascospores simple, colourless (rarely slightly brown, possibly due to degeneration), ellipsoid or curved, with a central plasma bridge when young, (7-)9-11 x 3.5-6 μm .

Pycnidia adnate, olive, 55-90 μm broad, conidiophores with 2-5 rectangular conidiogenous cells, conidia rod-shaped, c. 3 x 1 μm .

Ecology and distribution. H. subantarctica is a lichen of temporarily moist faces of volcanic rocks, on river banks and lake shores and has been collected so far only in Marion and Kerguelen Islands. In Marion Island the lichen was associated with species of Bacidia, Buellia, Catillaria, Caloplaca, Verrucaria and two undescribed cyanophilic genera (holotype), a new species of Zahlbrucknerella (Henssen 28168b) or Placopsis macrophthalma (Hook. f. & Taylor) Nyl. (Henssen 28170a) respectively.

The epithet "marionensis" for the new species used in unpublished scientific reports of our expedition, was no longer appropriate when material from the Kerguelen Island became known; it was therefore replaced by "subantarctica".

REMARKS. The Kerguelen Island material differed slightly in the size of the excipulum proprium, subhymenium, and asci but only a few apothecia were available for study.

Hertella subantarctica greatly resembles Spilonema paradoxum Bornet in habit, having an olive, filamentous, minute thallus bearing adnate apothecia, but is easily distinguished by the different symbiotic alga which is Stigonema or Hyphomorpha in Spilonema species (Henssen 1963, 1981). Furthermore, the apothecia in S. paradoxum are globose from the beginning, without a proper margin, and uniformly dark in colour, and the epithecium is dark green or violet. In H. subantarctica the hymenium can be striated, olive in the upper and lower and colourless in the central parts. Spilonema belongs to the Coccocarpiaceae, an isolated lichen family (Henssen 1963, Henssen et al. 1981).

Hertella chilensis Henssen spec. nov.

Figs. 4, 8-10, 11, 13, 15, 18.

DIAGNOSIS. Thallus saxicola, minutus, filamentosus, gelatinosus, olivaceus, diffusus, 2-7 mm latus, strato gelatinoso substrato affixus. Fila solitaria, circiter 0.3-0.35 mm longa et 0.01-0.02 mm crassa. Hyphae 1-2(-5) μ m crassae. Alga ad Tolypothrix pertinens ramis singularibus.

Apothecia rufo-fusca, usque ad 0.3 mm lata, discus primo planus et excipulo proprio pallido circumdatus, in statu vetusto discus convexus et excipulum proprium evanescens. Hymenium amyloideum, circiter 60-70 μ m altum, excipulum 45-90 μ m latum, parenchymatum, cellulis isodiametris. Paraphyses sparsim ramosae, 2 μ m latae, apicem versus ad 3 μ m incrassatae. Asci amyloidei, cylindraneo-clavati, 45-60 x 4.5-7 μ m, octospori. Sporae eseptatae, incoloratae, ellipsoideae vel curvatae, 7-8.5 x 3.5-5 μ m (immaturae in asco). Pycnidia 35 μ m lata, conidiophora brevicellularia, conidia terminalia et lateralialia formantia, conidia bacilliformia, 3-3.5 x 1 μ m.

Holotypus: Chile, Prov. Llanquihue, Parque Nacional Vicente Perez Rosales, Salto de Petrohué, 1800 m s.m. 1973, Henssen, Vobis & Redon 24326b (MB).

Thallus small, olive, filamentous, diffuse, 2-7 mm broad, fastened by a gelatinous attachment base. Lobes horizontal or erect, 0.3-0.35 mm

long, 0.01-0.02 mm thick. Phycobiont a species of Tolypothrix, false branches single with one or two basal heterocysts, trichomes 10-14 μm broad with gelatinous sheath 17-22 μm (water preparation). Hyphae in one or two layers extending within or outwards the gelatinous sheath of the algal trichome, in young stages 1-2 μm thick, in later stages cells enlarged to 5 μm and forming an entire sheath around the algal filament. Haustoria globose, formed by short side branches.

Apothecia reddish brown, to 0.3 mm broad, disc at first flat and surrounded by a pale proper margin, in later stages convex with the proper margin excluded. Hymenium 60-70 μm tall, brown in the upper part, in iodine deep blue, hypothecium 45-55 μm tall, inverse cone-shaped, light brown. Excipulum proprium cupular, pale, 45 μm broad in the upper part and 50-90 μm at the base, pseudoparenchymatous, composed of isodiametric, 4.5-9.5 μm wide cells with thin walls. Paraphyses 1.5- 2 μm thick, enlarged to 3 μm at the tip, sparsely branched in the upper part. Asci cylindrical to clavate, 47-60 x 4.5-7 μm , 8-spored, apex thick-walled with amyloid caps or a faint apical ring-structure. Ascospores simple, colourless, ellipsoid or curved, with a central plasma bridge when young, 7-8.5 x 3.5-5 μm .

Pycnidia adnate, c. 35 μm broad, reddish brown, conidiophores with a few short conidiogenous cells, conidia rod-shaped, c. 3.5 x 1 μm .

Ecology and distribution. H. chilensis is so far known only from the type Locality, the Valdivian rainforest in southern Chile, where the lichen was growing near a waterfall on a shady granite boulder associated and in part overgrowing Parmeliella nigrocincta (Mont.) Müll.Arg.

Reports on the lichen flora of the Valdivian rainforest in the Vicente Perez Rosales National Park are given by Redon (1972, 1974), who emphasized corticolous species. Hertella chilensis and Parmeliella nigrocincta both are additions to the flora of this lichen rich area.

The epithet "chilensis" was chosen to indicate the collecting site.

REMARKS. The two Hertella species are closely related. H. chilensis can be recognized by the consistently red-brown apothecia, while in H. subantarctica they are usually olive or blackish although in some thalli brown-coloured discs have also been observed. Further distinguishing characters of H. chilensis are the branching type of the algal filaments, with corresponding morphological differences of the lobes, the excipulum proprium composed of thin-walled isodiametric cells, and the somewhat thicker paraphyses with vacuolated cells in parts.

The type collection was too small to permit analyses for lichen substances.

ACKNOWLEDGEMENTS

The study was supported by the Deutsche Forschungsgemeinschaft. I am greatly indebted to the South African authorities of the Antarctic Research Program for the invitation and support during the expedition to Marion Island. My sincere thanks are due to Mr Valdon Smith, Bloemfontein the leader of the biological group on Marion Island and to Dr J. Redon, Valparaiso who organized our field trips in Chile. I am indebted to Dr L.J.-C. Massé, Rennes who provided us with the interesting undetermined material of cyanophilic lichens collected by the French expeditions to the Kerguelen Island. Mr A. Titze is thanked for the analyses of the lichen substance, Mrs G. Traute for technical assistance. Prof. D.L. Hawksworth kindly read the manuscript.

ZUSAMMENFASSUNG

Die neue Flechtengattung Hertella Henssen wird mit den beiden neuen Arten H. subantarctica Henssen und H. chilensis Henssen beschrieben. H. subantarctica, die Typusart, wurde auf den subantarktischen Prince Edward Inseln und den Kerguelen gefunden, H. chilensis ist nur von der Typuslokalität im südlichen Chile bekannt. Nach Struktur und Entwicklung der hemiangiocarpen Apothecien ist Hertella eine Gattung der Peltigerales, ihre Zuordnung zu der z.Zt. nicht scharf umgrenzten

Familie der Placynthiaceae wird vorgeschlagen.

Kennzeichnend für Hertella sind kleinfädige Lager mit lateral aufsitzenden, braunen oder schwärzlichen Apothecien, die von einem pseudo-parenchymatischen, in jungen Stadien als heller Eigenrand hervortretendem Excipulumbecher umgeben sind.

Unterscheidungsmerkmale von habituell ähnlichen Spilonema-Arten sind der helle Excipulumbecher und die symbiotischen Algen: Scytonema oder Tolypothrix bei Hertella, Stigenoma oder Hyphomorphia bei Spilonema.

Die Morphologie der fädigen Loben der Hertella-Arten richtet sich nach dem Verzweigungstyp der symbiotischen Blaualge. Bei H. subantarctica mit Scytonema als Phycobiontem sind die Loben einzeln oder gepaart, bei H. chilensis mit Tolypothrix einzeln. Die Hyphen verlaufen parallel in Längsrichtung der Fäden innerhalb oder außerhalb der Algengallerte und können bei älteren Lagern von H. chilensis einen geschlossenen Mantel um die Algenfäden bilden. Haustorien werden von kurzen Seitenhyphen entwickelt.

H. subantarctica enthält ein unbeschriebenes Depsid mit dem Rf-Wert 23 in Fließmittel C, von H. chilensis lag nicht genügend Material für eine Analyse von Flechtenstoffen vor.

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A NEW SPECIES OF *PODOSPORA* FROM MARINE SEDIMENT

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SUMMARY

Podospora inquinata sp. nov. is described and illustrated from marine sediment collected in the Nagasaki Bay, Japan. This species is compared with *Podospora macropodalis*. The effect of salinity on ascospore germination and growth also was tested.

In the Sordariaceae, the genus *Podospora* has been recognized, ecologically, as one of the representatives of the coprophilous fungal community. In fact, the perithecia of this genus are easily seen on the dung of grazing animals such as cow, horse, sheep, deer, moose and rabbit. In their monographic study of *Podospora*, Mirza and Cain (1969), who recognized 64 species, included only 5 species recorded from non-coprophilous sources: *P. curvispora* (Cain) Cain and *P. inaequalis* (Cain) Cain from seeds of *Daucus carota* var. *sativa*, *P. minor* Ell. & Everh. from old stalks of *Zea mays*, *P. unicaudata* (C. Moreau & M. Moreau ex Smith) Cain from the felt lining of an ammunition box stacked in a gold mine in South Africa, and *P. vesticola* (Berk. & Br.) Mirza & Cain from the lining of an old gown, found in Batheaston, England. Records of coprophilous members from other substrates include, *P. nannopodalis* Cain reported by Gochenaur (1970) from Peruvian soil. Infrequent isolations of some coprophilous species such as *P. pauciseta* (Ces.) Trav. (= *P. anserina* (Ces. ex Rabenh.) Niessl), *P. communis* (Speg.) Niessl, *P. setosa* (Wint.) Niessl, *P. curvicolla* (Wint.) Niessl and *P. decipiens* (Wint.) Niessl from plant materials

and soil also have been recorded by Lundqvist (1972). However, such isolations comprise a small percentage of their usual substrate selection.

During investigations of the microfungi in marine sediments from polluted areas of Nagasaki Bay, Japan (Ueda and Udagawa, 1983), an interesting culture of *Podospora* sp. was isolated from a sample collected in 1979. This fungus has proved to be sufficiently different from all described species of the genus to warrant its erection as a new species, as well as representing the first record of *Podospora* from marine environments (Kohlmeyer and Kohlmeyer, 1979).

The specimens studied are preserved in the Mycological Herbarium, National Institute of Hygienic Sciences, Tokyo (NHL) and the Cryptogamic Herbarium, Department of Botany, University of Toronto, Canada (TRTC). The living cultures of this species have been deposited at the American Type Culture Collection, Rockville, Maryland, U. S. A., the Centraalbureau voor Schimmelcultures, Baarn, Netherlands, and the National Institute of Hygienic Sciences, Tokyo, Japan.

Podospora inquinata Udagawa & Ueda, sp. nov. (Figs. 1-4)

Coloniae in agar farina avenacea confecto celeriter effectae, planae, tenues, olivaceo-nigrae vel viridi-nigrae, perithecia numerosa producentes; reversum olivaceo-nigrum.

Perithecia superficialia vel immersa, dispersa vel in catervis parvis aggregata, nigra, pyriformia, 400-550 × 280-400 μm, inferne pilosa; pili dispersi, longi, flexuosi, septati, leves, olivaceo-brunnei, 1.5-2.5 μm diam; collum brevi-conicum, nigrum, 120-165 × 135-160 μm, glabrum. Peridium perithecii tenue, olivaceo-brunneum, opacum, membranaceum, ex 'textura angularis' compositum; stratum exterius ex cellulis brunneis, incrassatis, angularibus, 8-15(-18) × 6-12 μm compositum; stratum inferius ex cellulis hyalinis. Asci octospori, clavati, 160-200(-240) × 25-32 μm, superne contracti et late rotundati, sine annulo incrassato spectati, basin versus in stipitem usque 40-60(-80) μm longum attenuati, evanescentes, cum hyphis hyalinis filiformibus, septatis, 1.5-2 μm diam circumcincti. Ascosporae biseriales, primo hyalinae, deinde valde olivaceo-brunneae vel atrobunneae, opacae, late ellipsoideae, (22.5-)25-30(-34) × (15-)18-20(-25) μm (av. 27.7 × 18.5 μm), utrinque attenuatae, poro germinali apicali, 2-2.5 μm diam instructae; appendix primaria hyalina, cylindracea, 18-24 × 6-7.5 μm; appendices gelatinosae (secundariae) hyalinae, cylindraceae vel doliiformes et obtusae, in sporae distali apice parum

excentrice dispositae, 5-25(-65) $\times$ 2.5-4.5 μm , cavae, in appendice primaria proxima apice dispositae, similes sed angustiores, fugacissimae.

Holotypus: e sedimento marino isolatus est, in Sinu Nagasaki vocato, in Japonia, 11.iv.1979, legit. S. Ueda. In Herbario NHL 2945. Isotypus: TRTC 50678.

Etymology: Latin, *inquinatus* = polluted, referring to the nature of the habitat.

Colonies on oatmeal agar growing rapidly, attaining a diameter of 4.7 to 5.0 cm within 2 weeks at 23°C, plain, thin, with vegetative mycelium largely submerged, producing numerous perithecia on the agar or in the substratum, olivaceous black to greenish black (Rayner, 1970; Munsell Nos. 10.OGY/2.2/1.6 to 1.5BG/2.0/0.9); reverse olivaceous black (Rayner; Munsell No. 10.OGY/2.2/1.6). Colonies on potato-carrot agar growing slowly, thin, with surface black from perithecia scattered on the agar, violaceous black (Rayner; Munsell No. 10.OP/1.9/1.3).

Perithecia superficial to immersed, scattered to often aggregated in small clusters, black, pyriform, 400-550 $\times$ 280-400 μm , covered on the lower portion with scattered, long, flexuous, septate, smooth-walled, olivaceous brown, 1.5-2.5 μm diam, hyphal-like hairs; neck short conical, black, 120-165 $\times$ 135-160 μm , glabrous. Perithecial peridium thin, olivaceous brown, opaque, membranaceous, textura angularis; outer layer consisting of brown, thick-walled, angular cells measuring 8-15(-18) $\times$ 6-12 μm ; inner layer of hyaline cells. Asci 8-spored, clavate, 160-200(-240) $\times$ 25-32 μm , contracted and broadly rounded above, with no distinct apical structure, tapering below into a long stipe reaching 40-60(-80) μm long, evanescent, surrounded by bundles of hyaline, filiform, septate hyphae measuring 1.5-2 μm diam, and often longer than the asci. Ascospores bi-seriate, at first hyaline, then becoming dark olivaceous brown to dark brown, opaque, broadly ellipsoidal, (22.5-)25-30(-34) $\times$ (15-)18-20(-25) μm (av. 27.7 $\times$ 18.5 μm), narrowed towards both ends, with an apical germ pore 2-2.5 μm diam; epispore thin; primary appendage hyaline, cylindrical, 18-24 $\times$ 6-7.5 μm ; secondary appendages hyaline, cylindrical to doliform and obtuse, loop-like, gelatinous, the upper one slightly eccentric at the apex of spore, not covering the germ pore, 5-25(-65) μm long and 2.5-4.5 μm wide at the base, hollow, and the lower one attached to the end of the primary appendage, similar but narrower and very fugaceous. Anamorph lacking.

At 37°C, only vegetative growth is developed.

Specimen examined: ex marine sediment, Nagasaki Bay,

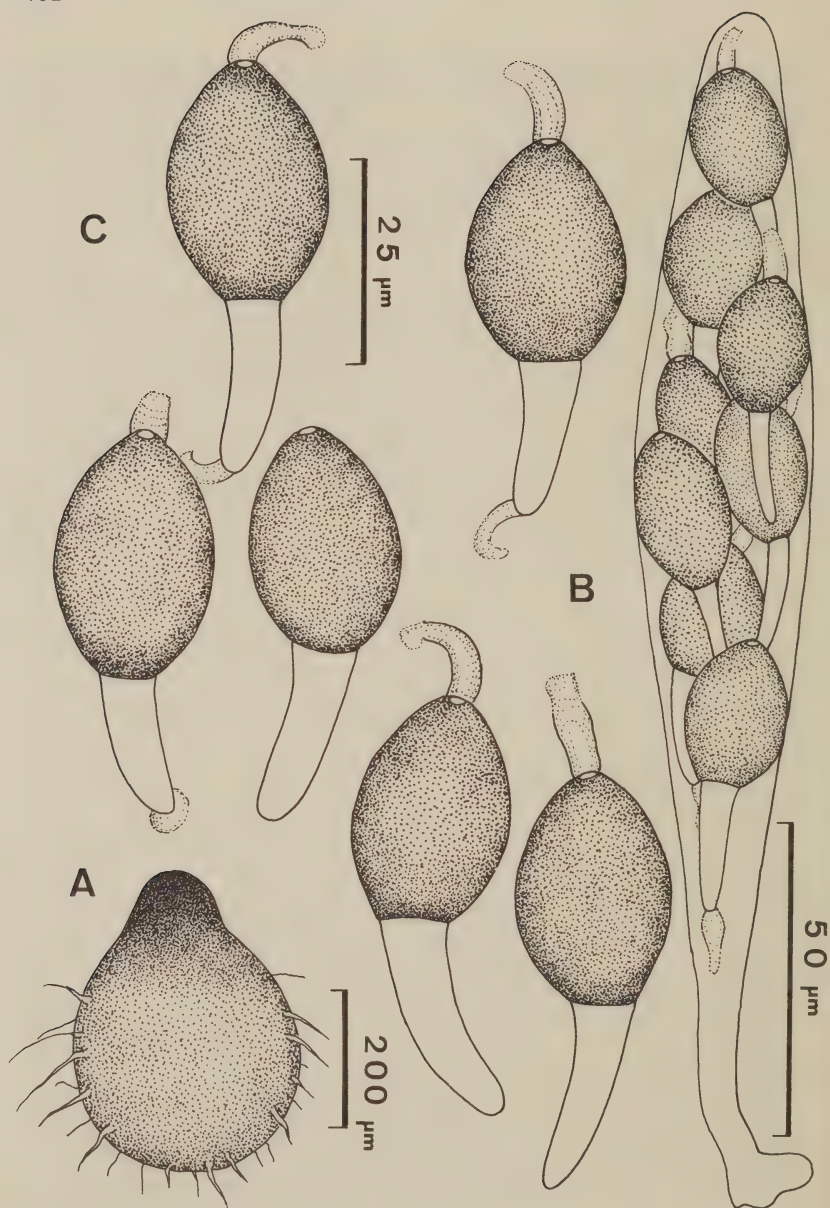
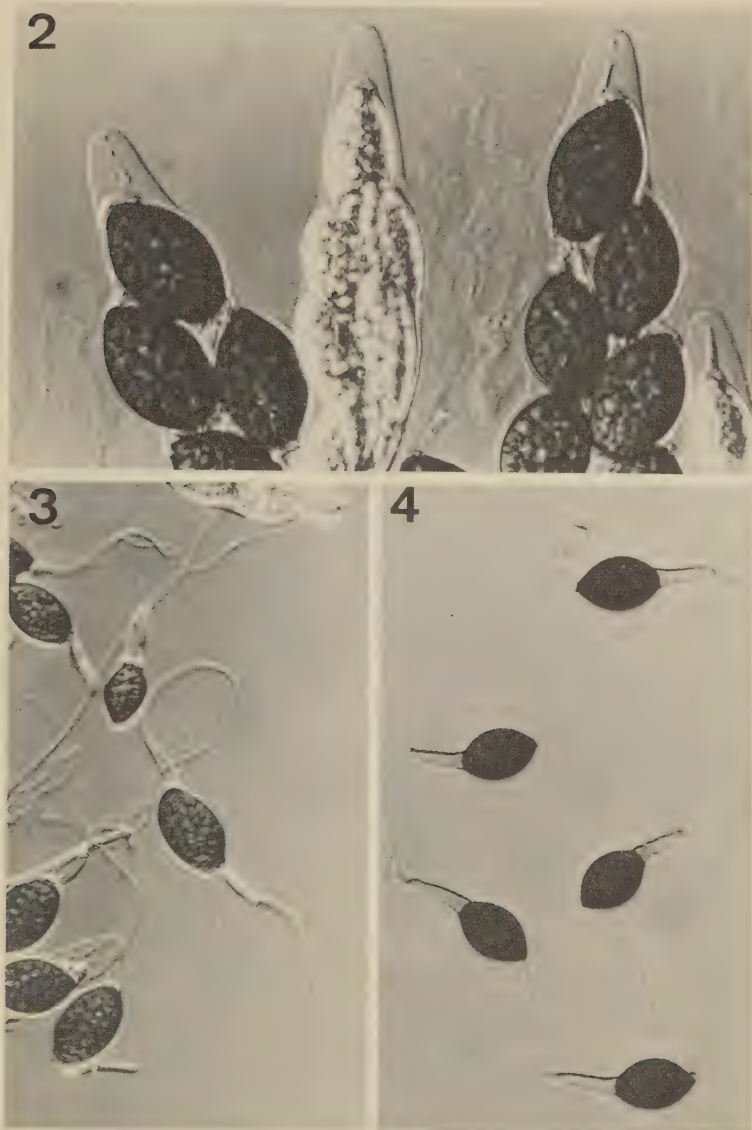


Figure 1. *Podospora inquinata*, NHL 2945.
A. Perithecium. B. Ascus. C. Ascospores.



Figures 2-4. *Podospora inquinata*, NHL 2945.
2. Apical portion of asci, indicating the absence
of an apical structure. $\times 750$. 3, 4. Ascospores.
 $\times 420$.

Nagasaki City, Nagasaki Prefecture, Japan, coll. S. Ueda, 11.iv.1979, NHL 2945 (Holotype).

P. inquinata is particularly unusual among the species of *Podospora* in that it is found in a marine environment and easily grows on common culture media. On the whole *Podospora* is a genus of dung inhabiting species with a few known from soil.

This fungus is close to *P. macropodalis* Mirza & Cain (1969). The latter species, only known from a single coprophilous collection from Mexico, is distinguished by its smaller, broadly ellipsoid ascospores which have a longer and narrower primary appendage (from our examination of the type material (TRTC 39494, holotype) the spore size is $24\text{--}26 \times 14\text{--}15 \mu\text{m}$, whereas $21.5\text{--}25.5 \times 15\text{--}17.5 \mu\text{m}$ is given in Mirza and Cain's description; the measurement of the primary appendage is $25\text{--}29 \times 4.5\text{--}5.0 \mu\text{m}$ according to Mirza and Cain). In addition, there seems to be a difference in the secondary appendage. This appears to be narrower and straighter in *P. inquinata* although it sometimes does loop at the end. Furthermore, based on the illustrations of *P. macropodalis*, the secondary appendage appears to be whip-lash in that species while in *P. inquinata* this is not so. Another significant feature of *P. inquinata* is the size of asci and the absence of an apical structure in the end of the ascus. In *P. macropodalis* the asci are smaller, $120\text{--}130 \times 20\text{--}30 \mu\text{m}$, and tapering below into a very short stipe.

To assess the adaptability of *P. inquinata* in marine environments, ascospore germination and growth responses to seawater media graded in salinity were examined. As seen in Table 1, this fungus showed maximum ascospore germination (86%) at 25°C on distilled water agar decreasing gradually with increasing salinities to 15% germination on 60% seawater agar, and at salinities above this level strong inhibition of spore germination was observed with almost total inhibition on 100% seawater agar. In another experiment the effect of change in salinity was tested on this fungus. Contrary to the effects on spore germination, Table 2 shows that the vegetative growth of *P. inquinata* was not inhibited by the seawater. In both surface and submerged cultures, optimum growth was observed at relatively high salinities, from 50% to 100% seawater.

The results of this study suggest that *P. inquinata* can exist in saline situations but that its presence in marine habitats may only be transient as a vegetative colonizer.

Table 1. Effect of varying salinities on ascospore germination of *P. inquinata* at 25°C, after 40 hr.

Seawater(%)*	Germination(%)**	Seawater(%)	Germination(%)
0	86.8	60	15.0
10	43.6	70	2.6
20	38.4	80	1.2
30	59.0	90	1.6
40	26.0	100	<0.5
50	22.0		

* Natural seawater (salinity: 33.2 ‰).

** Germination test : one drop of a spore suspension (10^3 spores/ml of distilled water) was placed on each agar disk containing seawater. The salinity was adjusted by distilled water.

Table 2. Growth of *P. inquinata* in seawater medium at various salinities, 25°C

Seawater(%)*	Radial growth (diam, mm)		Submerged growth (dry wt, mg)**
	at 10 days	at 25 days	at 10 days
0	5-6	10	83
10	10-11	20-30	62
20	8-10	30-38	25
30	10-11	30-35	41
40	10-12	30-45	106
50	15-16	40-55	128
60	16-17	45-50	125
70	16-20	45	101
80	20-22	50	121
90	20-22	55-60	129
100	24-25	65	139

* Medium: Seawater (natural, salinity 33.2 ‰) Yeast Extract Glucose Agar for radial growth and Seawater Yeast Extract Glucose Broth for submerged growth (Stevens, 1974). The salinity was adjusted by distilled water.

** Incubated by using a rotary shaker at 110 r.p.m. After incubation the mycelial mat was collected by filtration (0.45 μ m membrane filter) and dried at 105°C, 2 hr.

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A NEW SPECIES OF LEPTODISCELLA

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SUMMARY

Leptodiscella chlamydospora Udagawa & Toyazaki,
a new species, is described and illustrated from
an isolate from house dust collected in Osaka,
Japan.

The fungus described here was isolated by the junior author (N. T.) during a survey of the mycota in the domestic environment. The house dust from selected sites of 9 apartment houses in Suita City, Osaka, Japan, was sampled for fungi and allergens during November, 1983. Its isolation was made from dilution plates of the dust prepared with mycosel agar (BBL). The fungus belongs to the genus *Leptodiscella* Papendorf (1969) but is clearly distinct from the two taxa of this genus described hitherto.

Leptodiscella chlamydospora Udagawa & Toyazaki, sp. nov.
(Figs. 1-6)

Coloniae in agar 'potato-carrot' aliquanto restrictae, post 12 dies sub 23°C 24-32 mm diametro, humidae, tenues, ex mycelio submerso et mycelio aereo sparso prostrato compositae, aliquantum radiatim sulcatae, fumosae vel subolivaceo-griseae; ad centrum conidia abundanter producta sed chlamydosporae dispersae; reversum bubalinum vel fumosum vel griseo-aurantiacum.

Mycelium superficiale vel immersum, saepe sparsum, ex hyphis ramosis, septatis, laevibus, dilute olivaceo-brunneis vel brunneis, 1-3 µm diam, interdum fasciculatis com-

positum. Conidiophora micronemata vel semimacronemata, mononemata, brevia, haud distincta, hyalina, $5-40 \times 1.5-2 (-2.5) \mu\text{m}$, laevia, septata. Cellulae conidiogenae intercalares vel terminales, aliquantum inflatae, ca $3-5 \mu\text{m}$ diam, hyalinae vel leviter brunneae, holoblasticae, discreteae vel in conidiophoris incorporatae et sympodiales, laeves, tenues, subglobosae vel irregulares, saepe aggregatae et sporodochiorum similes formantes. Conidia ex hyphis singulatim producta vel aggregata in cellulis conidiogenis, primo hyalina, aseptata, guttulata, deinde dilute brunnea et transverse $1(-3)$ -septata, cylindracea vel parum allantoidea, apicem rotundata, ad septum centre interdum plus minusve constricta, $8-14 \times 3-5 \mu\text{m}$, laevia, cum setula simplici, filamentosa, sublaterali, usque $2-4 \mu\text{m}$ longa, in capitulum mucosum incoloratum aggregata. Chlamydosporae terminales vel intercalares, sessiles vel stipitatae, singulares vel muriformes vel plerumque longe catenatae, ex cellulis vulgo subglobosis, $6-10 \mu\text{m}$ diam, laevibus, crassitunicatis, brunneis compositae.

Holotypus: cultura, NHL 2946, ex materia pulveratus in domo, Suita, Osaka, in Japonia, in 22.ii.1984, a Toyazaki, isolata. In collectione fungorum 'National Institute of Hygienic Sciences (NHL), Tokyo, Japan'.

Etymology: Gk. comp. *chlamyd-* = wearing a cloak and *-sporus* = -spored, referring to the appearance of chlamydospores.

Colonies on potato-carrot agar growing rather restrictedly, attaining of a diameter of 24 to 32 mm within 12 days at 23°C , wetted, thin, composed of a layer of submerged mycelium and sparse, prostrate aerial mycelium, somewhat radially furrowed, abundant conidia produced in the central area, with dark pigmentation accompanying the appearance of sparse chlamydospores, 'Smoke Grey' (Rayner, 1970) or dull green (Methuen 28D3 from Kornerup and Wanscher, 1978); reverse 'Buff' to 'Smoke Grey' (Rayner) or grayish orange (Methuen 5B3).

Mycelium superficial or immersed, often sparse, composed of branched, septate, smooth-walled, pale olivaceous brown to brown, $1-3 \mu\text{m}$ wide hyphae which are sometimes aggregated into a bundle. Conidiophores micronematous or semi-macronematous, mononematous, short, barely distinguishable from the conidiogenous cells and hyphae, hyaline, $5-40 \times 1.5-2(-2.5) \mu\text{m}$, smooth-walled, septate. Conidiogenous cells intercalary or terminal, somewhat swollen, ca $3-5 \mu\text{m}$ wide, hyaline or sometimes brownish and darker than the neighbouring cells, holoblastic, discrete or integrated and sympodial, smooth, thin-walled, subglobose or irregular,

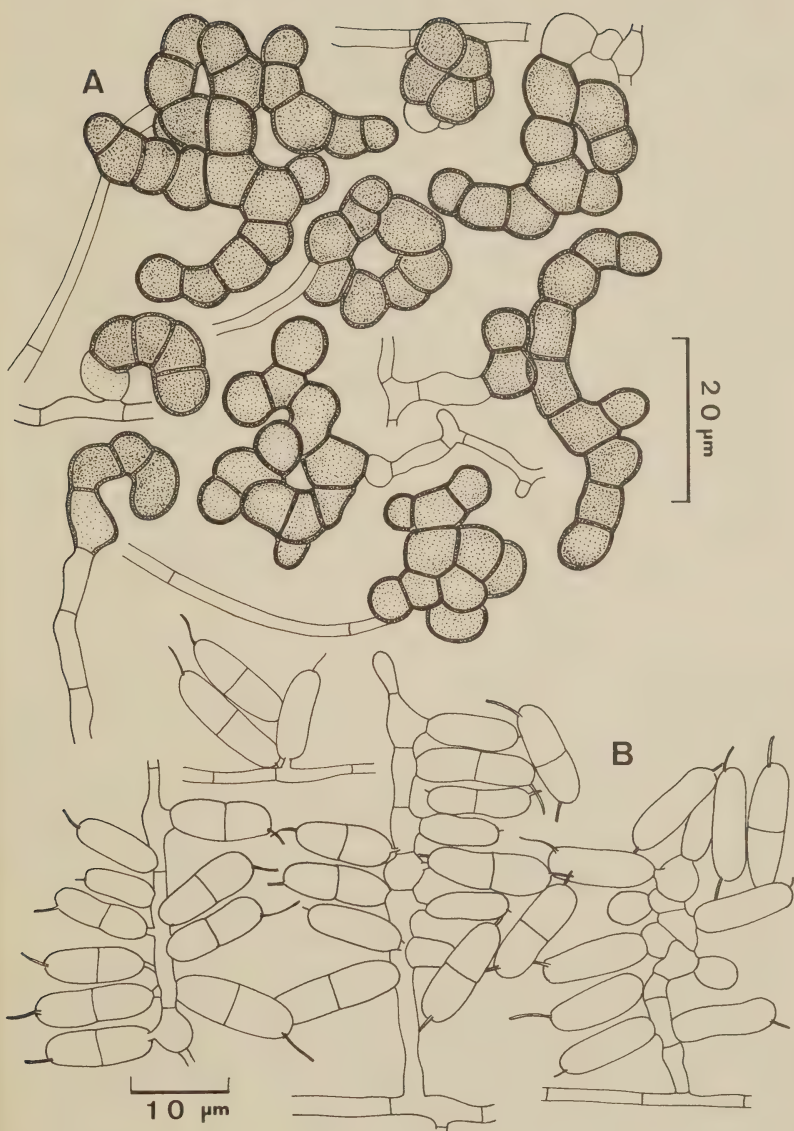


Fig. 1. *Leptodiscella chlamydospora*. A. Chlamydospores.
B. Conidiogenous cells and conidia.

often aggregated and forming irregular masses of abundant conidia resembling a small sporodochium. Conidia borne singly on hyphae or in groups on the swollen conidiogenous cells, at first hyaline, aseptate, guttulate, becoming pale brown and transversely 1(-3)-septate in age, cylindrical to slightly allantoid, rounded at the apex, sometimes more or less constricted at the central septum, $8-14 \times 3-5 \mu\text{m}$, smooth, with a simple, filamentous setula sublaterally at each end, up to $2-4 \mu\text{m}$ long, gathered in hyaline gloeoid heads, germinated from the both ends. Chlamydospores abundant among immersed hyphae but also scattered on aerial hyphae, terminal or intercalary, sessile or borne at the apex of a hypha, produced singly or as a muriform knot of cells, or more frequently in helicoid or twisted chains up to 10-40 cells (totally $10-25 \mu\text{m}$ or more long); each cell variable in shape, but mostly subglobose, $6-10 \mu\text{m}$ in diam, smooth, thick-walled, brown, not readily separating.

Colonies on oatmeal agar growing restrictedly, attaining a diameter of 17 to 23 mm within 12 days at 23°C , floccose, composed of more abundant aerial growth, more or less wrinkled, 'Olivaceous Grey' (Rayner) or grayish brown (Methuen 5F3); reverse 'Iron Grey' (Rayner) or greenish gray (Methuen 29F2), with surrounding agar colored in pale orange shades (Methuen 5A3).

At 37°C , growth is nil.

Specimen examined: an isolate from house dust, Senri-gaoka, Suita-city, Osaka-pref., Japan, coll. N. Toyazaki, developed on mycosel agar in Mycology Laboratory of Public Health Research Institute of Kobe City, 22.ii.1984, by N. Toyazaki, NHL 2946, holotype.

The genus *Leptodiscella* was established by Papendorf (1969) to accommodate the taxon previously described as *Leptodiscus africanus* (Papendorf, 1967), which shows close similarity to *Leptodiscus terrestris* Gerdemann (1953) but in which there are some fundamental morphological and developmental differences. *Leptodiscus* Gerdemann (1953) was characterized by black sclerotia, superficial plate-like yellow to fuscous acervuli and 1-septate, hyaline, allantoid conidia with a setula at each end. Ostazeski (1967) provided the new name *Mycoleptodiscus* to replace *Leptodiscus* Gerdemann, a later homonym of *Leptodiscus* Hertwig, 1877. According to Sutton's description, the fruiting structures of *Mycoleptodiscus* are superficial, plate-like, developing radially from a central cell to form a thin stroma one-cell thick and comprised of an aggregation of phialidic conidiogenous cells (Sutton, 1973). In *Leptodiscella*, the conidia are produced either on conidiogenous

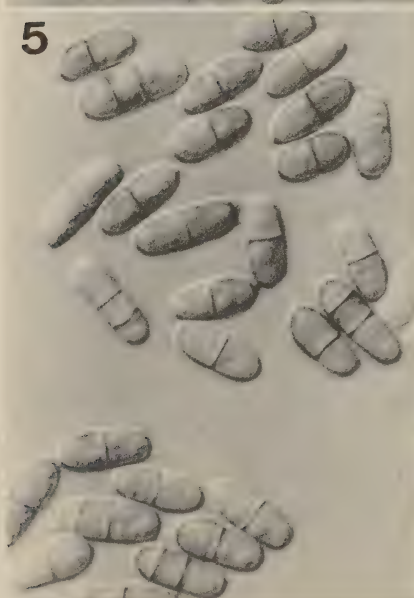
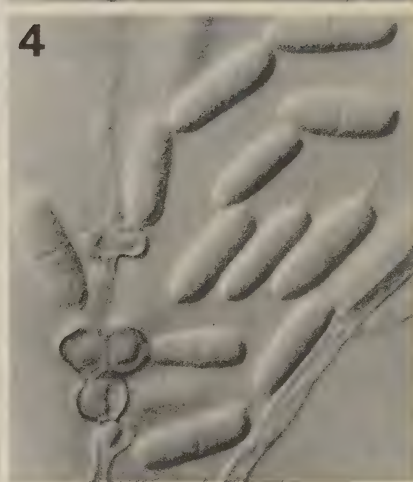
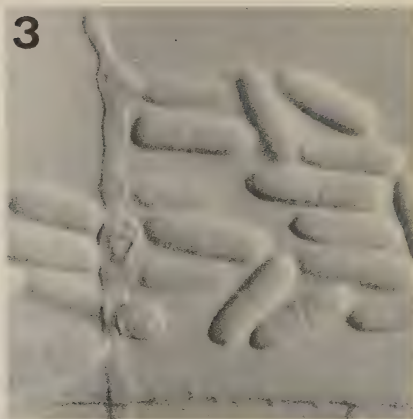
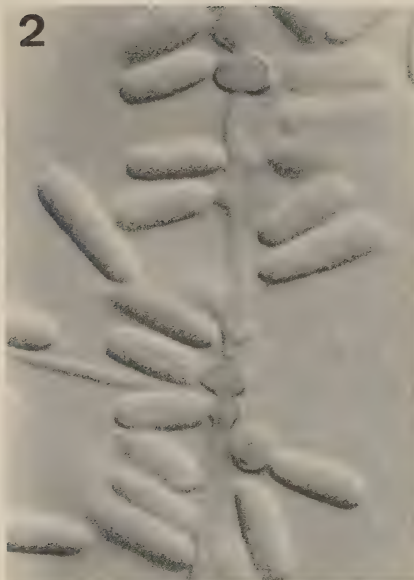
cells which are aggregated in pseudostromatic structures resembling sporodochia, or borne directly on the hyphae, either sessile or on short stalks. Conidial development is not phialidic and is apparently raduliform (Carmichael et al., 1980). The conidiogenesis and conidial morphology of *Leptodiscella* are also reminiscent of those of *Hyphodiscosia* Lodha & Chandra Reddy (1974). However, *Hyphodiscosia* is readily separated from *Leptodiscella* by the well-developed conidiophores, each with an apical swollen conidiogenous cell, on which several conidiogenous loci are formed, and the absence of pseudostromatic structures resembling sporodochia.

Leptodiscella africana, the type species, was isolated from leaf-litter and top-soil of *Acacia karroo* community, Potchefstroom, Transvaal, Republic of South Africa. Its conidia are cylindrical, medianly 1-septate, $11-17.5 \times 2-3 \mu\text{m}$ ($10-16 \times 2.5-3 \mu\text{m}$ in our measurements for ATCC 18416 strain) and with a single, unbranched setula $6.5-13 \mu\text{m}$ long near each end. Matsushima (1975, 1981) described a second species, *Leptodiscella japonica*, isolated from forest soil, Odaigahara, Japan, and later also collected on a decayed twig of *Quercus nigra*, Tallisee, Alabama, U. S. A. The species differs from *L. africana* in that the conidiophores are rather differentiated from hyphae, like *Dactylaria* spp., and attained up to $40 \mu\text{m}$ long. The conidia are somewhat ellipsoidal and broader ($12-17 \times 3.5-5 \mu\text{m}$).

Leptodiscella chlamydospora can be distinguished from the above two species by several features. The production of large, muriform or more often catenate chlamydospores, which show a superficial similarity to *Monodictys*, *Cirrenalia* and *Zalerion*-like fungi, is an unique feature of *L. chlamydospora*. With respect to the presence of chlamydospores, this species shows some similarity with some species of *Idriella* and *Dactylaria*. Other distinguishing features are shorter conidia and meager setulae.

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The authors are grateful to Professor R. D. Goos, Department of Botany of the University of Rhode Island, for reviewing the manuscript. They are also indebted to Dr. S-C. Jong, American Type Culture Collection, for providing culture of *Leptodiscella africana* for study.



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Figs. 2-6. *Leptodiscella chlamydospora*: 2-4, conidiogenous cells and young conidia; 5, matured conidia showing some 2-septate ones; 6, chlamydospore. (Figs. 2-5, $\times 1300$ and Fig. 6, $\times 850$)

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ADDITIONAL SPECIES OF CRUSTODERMA

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SUMMARY

Two new combinations, Crustoderma testatum and Crustoderma sabinicum, are proposed. Basidiocarp and culture descriptions of C. testatum are included.

INTRODUCTION

In an earlier paper (Nakasone, 1984), I discussed nine species of Crustoderma. Since then I have found that two additional species, Corticium testatum Jackson et Dearden and Hyphoderma sabinicum Manjón et Moreno, belong in Crustoderma. Methods and materials are described in Nakasone and Gilbertson (1982) and Nakasone (1984).

THE TAXA

Crustoderma sabinicum (Manjón et Moreno) Nakas., comb nov.

Basionym: Hyphoderma sabinicum Manjón et Moreno, Anales Jard. Bot. Madrid 40: 12. 1983.

Specimen examined: SPAIN--G. Moreno and J. L. Manjón No. 5614, on log of Juniperus thurifera L., Tamajón, Guadalajara, 7 III 1980 (part of holotype received from Dr. J. L. Manjón, Universidad de Alcalá de Henares, Madrid).

Remarks: See Manjón and Moreno (1983) for a description and illustration of this species. Their figure clearly shows a thickening subhymenium and pedunculate basidia. These are important characters found in Crustoderma. In the holotype I examined, the basidiospores are slightly thick-walled, as in other species of Crustoderma.

Crustoderma sabinicum is very similar to C. dryinum (Berk. et Curtis) Parm. but can be distinguished by three critical characters. First, the basidiocarps of the former species are lighter in color (Pale Ochraceous Buff with white margins) than in the latter. Second, although the basidiospore size overlaps, they are slightly wider in C. sabinicum (7-9 x (3.5-)4-4.5µm) than in C. dryinum (7.5-9.5 x 3.5-4(-4.5 µm)). Third, while C. dryinum has a worldwide distribution, C. sabinicum is known only from Spain.

I also received from Dr. Manjón a paratype specimen of H. sabinicum, G. M. and J.L.M. No. 5043. This specimen, however, is not

conspecific with the holotype No. 5614. Drs. J. L. Manjón and G. Moreno now believe that No. 5043 is a new species of Hyphoderma (personal communication).

Crustoderma testatum (Jackson et Dearden) Nakas., comb. nov. Fig. 1

Basionym: Corticium testatum Jackson et Dearden, Canad. J. Res., Sect. C, Bot. Sci. 27: 151. 1949.

Basidiocarp annual, effused, forming elongate, fusiform patches up to 60 x 20 mm, up to 250 μ m thick, adnate; fertile area continuous, smooth, with scattered warts, ceraceous, slightly velutinous, Cartridge Buff to Pinkish Buff; margin abrupt.

Hyphal system monomitic. Subiculum thin or absent, composed of tightly agglutinated hyphae arranged parallel to substrate; subicular hyphae 3.5-7.5 μ m diam, evenly or irregularly thick-walled, nodose septate, much branched. Subhymenium thickening, up to 200 μ m thick, composed of agglutinated, vertically arranged thick-walled cystidia and hyphae. Dendrohyphidia lobed or branched at apex, 40-50 x 1-5 μ m, hyaline, thin-walled, clamped at basal septum, smooth, arising from hymenium. Cystidia of two kinds: (a) clavate to cylindrical, 40-75 x 8-30 μ m, hyaline, slightly thick- to thick-walled, clamped at basal septum, smooth, not protruding, containing nonstaining, refractive and phloxine staining, nonrefractive materials, abundant throughout subhymenium and hymenium; (b) ventricose, 60-100 x 7-10 μ m, hyaline, thin-walled, clamped at basal septum,

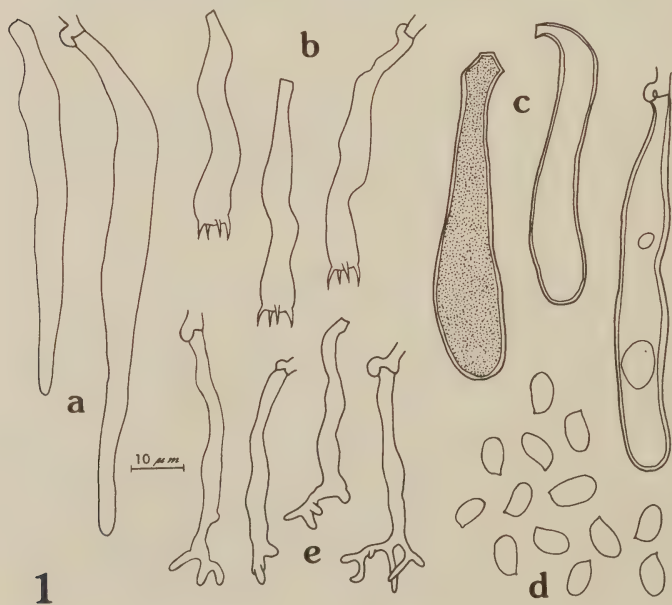


Fig. 1 (FP 133722)--a. Ventricose cystidia; b. basidia; c. clavate cystidia; d. basidiospores; e. dendrohyphidia. (ML84 5788)

smooth, protruding up to 65 μm , containing nonstaining, refractive and phloxine staining, non-refractive materials, numerous in hymenium. Basidia clavate, 30-50 x 5-6.5 μm , hyaline, smooth, thin-walled, clamped at basal septum, 4-sterigmate, sterigmata 4-5 μm long. Basidiospores ellipsoid, flattened on the adaxial side, 7-9.5 x 4-5 μm , hyaline, slightly thick-walled, smooth, negative in Melzer's reagent, acyanophilous.

Specimens examined: CANADA--BRITISH COLUMBIA: V-2627 on Pseudotsuga taxifolia (Lamb.) Britton, Cowichan Lake, Vancouver Island, 14 III 1947, coll. P. J. Salisbury (holotype, TRTC). U.S.A.--OREGON: FP 133722 on conifer, near Cougar Mountain, Lincoln County, 9 X 1973, coll. M. J. Larsen.

Culture description: Growth on 2% malt extract agar very slow, 55 mm diam by 6 wk, mats white, moderately thick, raised and woolly around inoculum, then becoming appressed and felty toward margin at 2 wk, by 6 wk white to Cream-Buffer, moderately thick, zonate, appressed and felty around inoculum, then becoming slightly raised, short-woolly towards margins; margins even to slightly uneven, appressed; odor none at 2 wk, fruity at 6 wk; agar unchanged at 2 and 6 wk; not fruiting by 6 wk. Oxidase reactions on 0.5% gallic and tannic acid agars negative and with no growth. Microscopic characters--Advancing zone hyphae 2.5-4.5 μm diam, slightly thick-walled, nodose septate, sparingly branched. Submerged and aerial hyphae 2-5.5(-10) μm diam, slightly thick-walled at first, then becoming irregularly thick-walled, nodose septate, moderately to frequently branched. Aerial mat with numerous, yellow, refractive globules. Chlamydospores globose to limoniform, 13.5-16 x 9-12 μm , hyaline, thin-walled at first, then becoming thick-walled, intercalary, scattered in submerged and aerial mats at 2 and 6 wk.

Remarks: Crustoderma testatum is easily distinguished from other species in the genus because it has dendrohyphidia and two kinds of cystidia. It is associated with a brown rot of conifers in British Columbia and the Pacific Northwest region of the U.S.A.

The specimen from Oregon is well developed, and the basidiocarp description is based primarily on that specimen. I also noticed some minutely rough-walled basidiospores in the specimen. Because these spores are smaller than the smooth basidiospores, I believe that they are immature basidiospores. The holotype specimen from British Columbia, however, is poorly developed. It lacks dendrohyphidia and a distinct, thickening subhymenium. The context consists of a gelatinous matrix with scattered hyphae and thick-walled, clavate cystidia. Despite these differences, I am convinced that the two specimens represent the same species. The size and shape of the two types of cystidia, basidia and mature basidiospores of the two specimens are similar.

ADDENDUM TO: KEY TO THE SPECIES OF CRUSTODERMA

In a key to the species of Crustoderma, both C. sabinicum and C. testatum key out to the same place, couplet 11 (Nakasone 1984, p. 49). The key section found below incorporates the two species treated here into my earlier key.

- 11a. With two types of cystidia, thin-walled, ventricose
and thick-walled, clavate cystidia. C. testatum
- 11a. With one type of cystidia 11.b

- 11b. Basidiocarps nearly white (Pale Ochraceous-Buff); known only
from Spain. C. sabinicum
- 11b. Basidiocarps not white and not limited to Spain 11.c
- 11c. Rare species, known only from Austria and
Fennoscandia C. longicystidium
- 11c. Common species, widely distributed C. dryinum

ACKNOWLEDGMENTS

Specimens used in this study were obtained from Dr. J. C. Krug (TRTC) and Dr. J. L. Manjón, Universidad de Alcalá de Henares, Madrid. Ms. Frances F. Lombard and Dr. J. Page Lindsey reviewed this manuscript.

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STUDIES IN AGARICUS III: NEW SPECIES FROM CALIFORNIA¹

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Abstract

Eight new species of Agaricus from California are described. They are: Agaricus sequoiae, section Agaricus subsection Agaricus; A. vinaceovirens, section Agaricus subsection Bitorques; A. fuscovelatus and A. rubronanus, section Sanguinolenti; A. arorae, section Spissicaules; and A. smithii, A. summensis, and A. perobscurus in the section Arvenses.

Beginning with the publication of Agaricus californicus Pk. in 1895, thirteen new Agaricus taxa based on material from California have to date been published. These include A. bulbosus McClatchie, A. bivelatus Pk., A. subnitens Pk., A. pattersonae Pk., A. hondensis Murr., A. abramsii Murr., A. mcmurphyi Murr., A. crocodilinus Murr., A. albolutescens Zell., A. glabrus Zell., A. liliceps Zell., and A. placomyces Pk. var. microsporus A. H. Smith. A majority of these taxa are currently recognized as distinct. It is worth noting that of the thirteen only A. bulbosus was proposed by a collector residing in the state.

It is becoming increasingly apparent that California supports a great diversity of Agaricus species, including many new ones which may have restricted distributions. Forty-five species of Agaricus have been collected by the author in the state since 1972. Fourteen of these are undescribed, and of this group eight are described below.

1) Portion of a thesis submitted to San Francisco State University in partial fulfillment of the requirements for the M.A. in Biology.

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Agaricus species occur in many habitats in California. One of the most significant of these is the Monterey cypress (Cupressus macrocarpa Hartw.) grove habitat, from which more than twenty-five species of Agaricus have been recorded. Other new and interesting species have come from the extensive redwood (Sequoia sempervirens (D. Don) Endl.) forests, and from the mixed evergreen forest community (Pseudotsuga and Quercus).

Materials, methods, and conventions: Formulae for the reagents mentioned below are as follows:

KOH: a 3% aqueous solution

Aniline: pure, fresh

HNO₃: concentrated

2,4-Dinitrophenylhydrazine: a saturated ethanolic solution

o-Tolidine: 0.05 g in 3.5 ml of ethanol, + 6.5 ml of distilled H₂O

alpha-Naphthol: 0.5 g in 3.5 ml of ethanol, + 6.5 ml of distilled H₂O

These reagents are applied to the pileus surface unless otherwise noted. Aniline x HNO₃, or "Schaeffer's reaction," involves streaking aniline upon the pileus surface, followed by cross-streaking HNO₃; the reaction occurs at or near the junction of the cross.

Microscopic features were generally determined from dried material mounted in KOH (3%); rarely fresh material was used. Spore measurement data were obtained as described in Kerrigan (1982). Measurements and shapes refer to spores in profile view. Shape terminology and criteria are those of Bas (1969).

The plural term "veils" refers to the two distinctly different velar layers possessed by most, if not all, species of Agaricus. The partial veil extends from the apex of the stipe, across the hymenophoral cavity, to the tramal zone at the pileus margin. The universal veil surrounds the entire sporocarp primordium and apparently also extends between the stipe and the partial veil of the immature, unexpanded sporocarp. The annulus is typically composed of both layers. See also Atkinson (1914) and Romagnesi (1977) on the veils of Agaricus.

Color terms enclosed in quotation marks are from Ridgway (1912). Spore color refers to a spore deposit on white paper; this feature has not been found to vary greatly in Agaricus. Specimens cited below are deposited in the San Francisco State University Herbarium (SFSU).

Agaricus sequoiae sp. nov.

Fig. a.

Pileus 4-14 cm latus, subcylindricus vel convexus demum late convexus, laxe intertextus vel squamosus, albus;

contextus albus, immutabilis; odor mitis; stipes 8-30 cm longus, 1.8-3.0 cm crassus, plerumque aequalis, e farcto cavus; vela alba, interdum ex parte flavescens; sporae (6.4-) 7.1-7.9 (-9.0-10.1) x (4.1-) 5.0-5.3 (-6.4) μm ; basidia 30-40 x 7-13 μm , tetraspora; cheilocystidia nulla. Holotypus: R. W. Kerrigan 824, Mendocino Woodlands Camp, Mendocino Co., California. 20 November 1977. SFSU.

PILEUS 4-14 cm broad, convex to cylindrical, becoming very broadly convex, sometimes somewhat truncate; surface dry, fibrillose, the fibrils loosely interwoven, not tightly appressed, typically forming squamae (ca. 2-5 x 1-3 mm) with erect tips, colored white to light buff; background indistinguishable; context white, unchanging, semi-firm, to 2.5 cm thick, odor and taste mild.

LAMELLAE free, close, to 1.5 cm broad, pink to dull pink, "Fawn Color," becoming dark blackish brown, margin concolorous.

STIPE 8-30 cm long x 1.8-3.0 cm broad, equal or rarely ventricose; interior white, unchanging, stuffed-hollow, the cavity sometimes quite large; surface glabrous above, scurfy below, white, not changing immediately, but brownish, "Warm Sepia" stains sometimes developing long after handling; base deeply rooted in dense, silty soil.

VEILS white, sometimes in part becoming about "Primuline Yellow" in age, forming a scant to copious, friable, pendant or intermediate, supramedian annulus, or a series of annular bands, and/or a fringe of coarse, fibrillose squamules, often united at their tips, on the pileus margin, as well as various, often extensive remnants on the lower stipe.

SPORES (6.4-) 7.1-7.9 (-9.0-10.1) x (4.1-) 5.0-5.3 (-6.4) μm , dark brown, ellipsoid, hilar appendix rather prominent, germ pore not evident. BASIDIA 30-40 x 7-13 μm , clavate to cylindro-clavate, tetrasporic; sterigmata 3-4 μm long. CHEILOCYSTIDIA absent or basidiole-like. PILEIPELLIS of parallel or sub-parallel to interwoven, hyaline, smooth, thin-walled hyphae, cells (4.5-) 7.5-30 x 33-110 μm , cylindrical, or constricted at septae, or rarely ellipsoid.

CHEMICAL REACTIONS: KOH negative; aniline x HNO_3 negative; o-tolidine blue on basal stipe context, adjacent velar material, and pileus surface, elsewhere unchanging; alpha-naphthol pink on annulus, pileus surface, elsewhere essentially unchanging.

Solitary, gregarious, or caespitose (up to 50 per fascicle) in periodically-silted bottomlands in redwood forests. Known only from Mendocino County (possibly observed in Marin County), California. Oct. - Dec. Usually rare but occasionally almost common.

Material studied: CALIFORNIA. Mendocino Co.: R. W. Kerrigan 623, 744, 795-797, 809-813, 820-823, 824 (holotype), 825-827, 1083; K. Williams 239K77.

Observations: The unchanging color of the context, chemical reactions, and the absence of cheilocystidia place A. sequoiae in section Agaricus subsection Agaricus sensu Heinemann (1978). The unusual yellow tints that develop on the veil, as well as the typically large size, distinguish the species. Of the European species, A. chionodermus Pilát appears to most closely resemble A. sequoiae, but has larger spores. Locally, in its habitat, A. sequoiae will probably not be confused with other species, except perhaps with very pallid specimens of A. hondensis, which have a phenolic odor and turn yellow with KOH. At this point A. sequoiae appears to be restricted to those portions of the coastal redwood forest which are periodically inundated with turbid water from adjacent rivers. In the last 10 years it has been relatively abundant during only one season.

Agaricus vinaceovirens sp. nov.

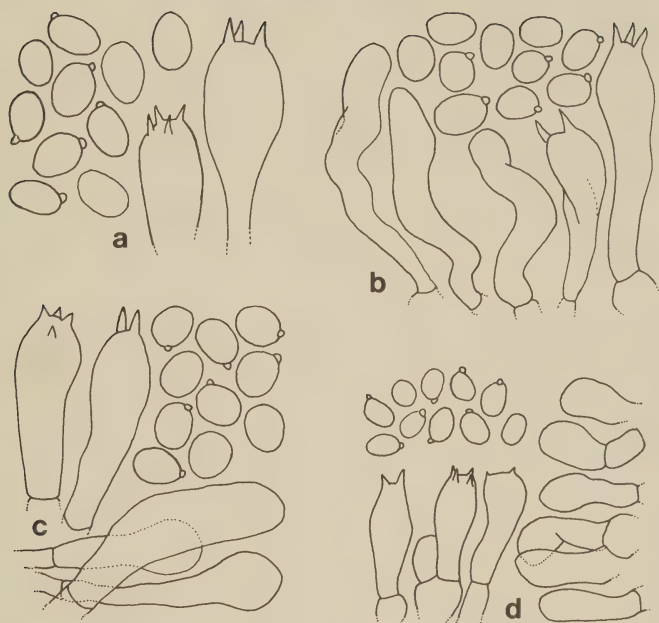
Fig. b.

Pileus 6-12 cm latus, convexus, margine valde involutus, demum subplanus vel depressus, laxe intertextus vel subsquamulosus, albus vel vinaceus, interdum ex parte virescens; contextus albus, immutabilis vel juxta cuticulam vinaceus, interdum virescens; odor mucido-salinus, ingratus; stipes 1.5-6 cm longus, 2-4 cm crassus, subaequalis, solidus; vela alba demum vinaceo-suffusa, peronata, saepe cupulata; sporae (5.3-) 6.2-6.7 (-7.9) x (4.1-) 4.6-5.0 (-5.6) μ m; basidia 25-36 x 7.5-9 μ m, tetraspora; cheilocystidia 17-39 x 6-10.5 μ m, undulata vel irregularia. Holotypus: R. W. Kerrigan 730, Colma, San Mateo Co., California. 7 October 1977. SFSU.

PILEUS 6-12 cm broad, broadly convex, sometimes depressed centrally, with strongly inrolled margin, finally almost plane; surface dry, with loosely interwoven, appressed to slightly repent fibrils, towards the margin often with semi-erect, pointed squamules, colored white to light brown, "Chamois," in age usually developing vinaceous tints, especially toward the margin, occasionally greenish tints also developing, especially near the disc; context white, unchanging after exposure except after several hours a narrow band below surface becoming vinaceous, also occasionally a second band colored "Tea Green" to "Celandine Green" developing directly below surface, firm, to 2.5 cm thick, odor strong, unpleasant, musty/briny.

LAMELLAE free, close, 3-8 mm broad, pallid salmon color, or more brownish, becoming dark blackish brown, margin pallid or obscurely so.

STIPE 1.5-6 cm long x 2-4 cm above, 2-3 cm below, equal, clavate to napiform, or cuneiform; interior white,



Figs. a-d. Basidia, basidiospores, and cheilocystidia of *Agaricus* spp.
 a. *A. sequoiae*, Kerrigan 795 (cheilocystidia lacking). b. *A. vinaceovirens*, Kerrigan 730. c. *A. fuscovelatus* Kerrigan 784. d. *A. rubronanus*, Kerrigan 1204. All $\times 900$.

unchanging, solid; surface glabrous where exposed (above veils), white, unchanging; base firmly rooted in substrate.

VEILS peronate, continuous from base, forming a saccate or appressed volva, with or without flaring, striate, upper limb, colored white, developing vinaceous tints above, loosely interwoven, appearing coactate.

SPORES (5.3-) 6.2-6.7 (-7.9) $\times$ (4.1-) 4.6-5.0 (-5.6) μm , dark brown, ellipsoid, hilar appendix prominent, germ pore not evident. BASIDIA 25-36 $\times$ 7.5-9 μm , clavate to cylindro-clavate, frequently predominantly trisporic, otherwise predominantly tetrasporic; sterigmata 2-4 μm long. CHEILOCYSTIDIA 17-39 $\times$ 6-10.5 μm , cylindro-clavate, usually contorted, lining the lamellar margin. PILEIPELLIS of semi-parallel to interwoven, smooth, thin-walled, hyaline hyphae, cells (3.5-) 6-9 (-12) $\times$ 30-80 (-190) μm , convoluted-cylindrical, often sharply curved.

CHEMICAL REACTIONS: KOH negative; aniline $\times$ HNO_3 negative; o-tolidine blue on surfaces and veils, sometimes

blue on context near surface at pileus margin, also on basal 2-3 mm of stipe context; otherwise unchanging; alpha-naphthol bright magenta on pileus cuticle and veils, otherwise unchanging.

Gregarious, always in rings in litter or soil under Cupressus macrocarpa. Known only from the San Francisco Peninsula. Oct. - Mar. Uncommon.

Material studied: CALIFORNIA. San Francisco Co.: R. W. Kerrigan 660, 664, 912, 913, 925, 926, 928, 929, 1005, 1009, 1196. San Mateo Co.: R. W. Kerrigan 667, 705, 706, 730 (holotype), 895, 896, 995, 997, 998, 1010, 1040.

Observations: The solid stipe, peronate veils, and strongly inrolled pileus margin place A. vinaceovirens in section Agaricus subsection Bitorques Heinem. The manner in which the vinaceous tints appear is distinctive, while the greenish tones, although only occasionally present, are to my knowledge unique among known species of Agaricus. The general habit, contorted cheilocystidia, and odor of brine are also shared by A. bernardii Quel. apud Cooke & Quel.; however that species is strongly rufescent, and its odor is neither musty nor particularly unpleasant. The odor of A. vinaceovirens is objectionable enough to provoke requests for removal of the specimens from a room. Agaricus bitorquis (Quel.) Sacc. also has a similar habit, however the pileus is usually glabrous, the odor is mild or pleasant, and the cheilocystidia are not contorted. In addition to these distinctions, all three of the species mentioned above have substantially different spore sizes.

Agaricus fuscovelatus sp. nov.

Fig. c.

Pileus 5-9 cm latus, conico-convexus demum subplanus, appreso-squamulosus vel fibrilloso-areolatus, cinnamomeus vel obscure cinnamomeus, sub fibrillis pallide violaceo-griseus; contextus ex albo rufescens; odor mitis, suavis; stipes 6-12 cm longus, 0.8-1.5 cm crassus, deorsum 1-2 cm crassus, sub aequalis, e farcto cavus; vela pendentia, albidula demum fusca; sporae (5.6-6.4-) 7.2-7.8 (-9.0) x (4.9-) 5.7-6.2 (-7.1) μm ; basidia 27-30 x 9-10 μm , tetraspora; cheilocystidia 21-47 x 7.5-12 μm , cylindrica, clavata vel subsphaeropedunculata. Holotypus: R. W. Kerrigan 791, Sunset Avenue, San Francisco Co., California. 8 November 1977. SFSU.

PILEUS 5-9 cm broad, hemispherical, or compressed, becoming conico-convex, finally almost plane; surface dry, appressed-fibrillose becoming squamulose, or fibrillose-areolate, or scurfy, at first colored medium brown, about "Avellaneous," later "Buffy Brown," "Buckthorn Brown," "Cinnamon-Brown," or darker after handling or with age; background colored whitish or more often "Pale Mouse Gray" or "French Gray," producing an overall subtle violet-grey cast; context white, slowly and weakly to moderately

rufescent, to 1 cm thick, odor after exposure becoming fruity/spicy.

LAMELLAE free, close, to 7 mm broad, greyish-pink becoming dark blackish brown.

STIPE 6-12 cm long x 8-15 mm above, 1-2 (-2.5) cm at broadest part, equal or rarely enlarged below or slightly ventricose; interior white, moderately rufescent throughout its length, especially in transverse section; surface smooth above, faintly fibrillose with velar fragments below, white, moderately strongly reddening when incised; base (1-1.5 cm) covered with soil.

VEILS forming a thin, pendant, apical to subapical, colored annulus dehiscing from pileus margin when pileus is approximately half-expanded, then collapsing; partial veil white, soon becoming "Drab," finally dark brown, "Carob Brown" to "Benzo Brown," especially below; universal veil primarily forming a thicker, whitish to "Cinnamon-Brown" dentate fringe on pileus margin, also sometimes leaving a ring of warts under the partial veil near the annular margin, or leaving very thin, darkening patches beneath entire partial veil, also forming small warts or, rarely, a scale-like ring on lower stipe.

SPORES (5.6-6.4-) 7.2-7.8 (-9.0) x (4.9-) 5.7-6.2 (-7.1) μm , dark brown, broadly ellipsoid to ellipsoid, hilar appendix conspicuous, germ pore not evident. BASIDIA 27-30 x 9-10 μm , clavate to ventricose, tetrasporic; sterigmata 3-5 μm long. CHEILOCYSTIDIA 21-47 x 7.5-12 μm , broadly cylindrical, clavate, or slightly sphaeropedunculate, in clusters, with basidia present on lamellar margin. PILEIPPELLIS of parallel or sub-parallel to semi-interwoven, smooth, thin-walled hyphae, appearing very pale reddish brown under oil at 1000x, cells (2-) 4.5-9 x 30-105 μm , contorted.

CHEMICAL REACTIONS: KOH negative; aniline x HNO_3 negative; o-tolidine blue on surface of stipe base, pileus cuticle, elsewhere violet; alpha-naphthol purple on surface of stipe base, pileus cuticle, elsewhere orange to pinkish-orange except unchanging on basal context of stipe.

Gregarious, sometimes abundantly so, to caespitose, sometimes in arcs, usually deeply rooted in bare, compacted, often coarse-textured soils, generally under various planted conifers (Cupressus, Abies, Cedrus, Pinus). Known from central coastal California. Sept. - Jan. Rather common.

Material studied: CALIFORNIA. Marin Co.: R. W. Kerrigan 951. San Francisco Co.: R. W. Kerrigan 683, 695, 790, 791 (holotype), 849. San Mateo Co.: R. W. Kerrigan 701, 779, 945, 996, 1006. Santa Cruz Co.: R. W. Kerrigan 934, 1013, 1014. Monterey Co.: R. W. Kerrigan 976, 1031.

Observations: Agaricus fuscovelatus is similar to A. pattersonae in many respects; for example the veils of both species become brown in age, however this is much less pronounced in A. pattersonae. Of the two, A. fuscovelatus has a smaller, more slender stature, and a more conic pileus when young. The violet-grey cast of the pileus background is subtle but with experience can be used to recognize the mushroom in the field. Agaricus annae Pilát appears to be similar but has longer, narrower spores; unfortunately Pilát published no information on the veils of that species.

Agaricus rubronanus sp. nov.

Fig. d.

Pileus 2-3 cm latus, conico-convexus demum subplanus, appresso-fibrillosus vel appresso-squamulosus, cinnamomeus, sub fibrillis pallidus; contextus ex albo rufescens; odor mitis; stipes 3.5 cm longus, 3-6 mm crassus, basi 8 mm crassus, aequalis vel subbulbosus, e farcto cavus; sporae (3.8-4.1-) 4.8-5.0 (-6.0-6.8) x (3.0-) 3.6-3.7 (-4.1-4.5) μ m; basidia 15-22 x 6-7 μ m, tetraspora; cheilocystidia 10-16 x 5-6 μ m, cylindrico-clavata. Holotypus: R. W. Kerrigan 1204, Colma, San Mateo Co., California. 7 December 1981. SFSU.

PILEUS 2-3 cm broad, shape when young unknown, later convex-truncate, finally approximately plane; surface dry, appressed-fibrillose becoming appressed-squamulose, squamules small (ca. 2-3 mm), pointed, colored medium brown, "Wood Brown," or darker in age; background pallid, quickly becoming red when bruised, especially on margin; context white, quickly strongly reddening when exposed, to 4 mm thick, odor indistinct.

LAMELLAE free, close, to 4 mm broad, pinkish, bruising rose color, becoming brownish, then blackish brown, margin pallid.

STIPE 3.5 cm long x 3-6 mm broad above, to 8 mm broad at base, equal or slightly bulbous; interior white, quickly moderately to strongly rufescent when sectioned, especially above, somewhat yellowish near base, lustrous, somewhat fibrous, stuffed-hollow; surface finely striate above, fibrillose below, becoming zonate in lower half, white, rufescent where incised, becoming brownish after handling or with age; base shallowly rooted in litter.

VELLS forming a thin (ca. 1 mm), scant, pendant, supramedian, white annulus with "Wood Brown" margin, upper surface finely striate, lower surface slightly scurfy, some velar remnants also present as occasional dentate flaps on pileus margin, and as fibrils on stipe.

SPORES (3.8-4.1-) 4.8-5.0 (-6.0-6.8) x (3.0-) 3.6-3.7 (-4.1-4.5) μ m, dark brown, broadly ellipsoid to ellipsoid, hilar appendix prominent, germ pore not evident. BASIDIA

15-22 x 6-7 μm , typically ventricose, tetrasporic; sterigmata 2-3 μm long. CHEILOCYSTIDIA 10-16 x 5-6 μm , cylindro-clavate, scattered, with basidia also present on lamellar margin. PILEIPELLIS of interwoven to sub-parallel, convoluted, branching, smooth, thin-walled hyphae, appearing light reddish-brown under oil at 1000x, cells 3-4.5 (-8) x 30-75 μm , contorted-cylindrical.

CHEMICAL REACTIONS: KOH negative.

Scattered in litter of Cupressus macrocarpa. Known only from San Mateo County, California. Dec. Rare.

Material studied: CALIFORNIA. San Mateo Co.: R. W. Kerrigan 1204 (holotype).

Observations: The most striking feature of A. rubronanus is its diminutive size. It might at first be mistaken for the more common A. semotus Fr., or a similar species, until the rufescence of the context is noted. Agaricus placomyces var. microsporus is another small, rufescent, very rare species which has a blackish, rather than a brown, pileus. Other small-spored species in section Sanguinolenti (Schaeff. & Møll.) Sing. are considerably larger. The most similar of these, A. silvaticus Schaeff. ex Secr. sensu Møll. (which incidentally has not been found in California), has a pileus which is 5-10 cm broad, and much larger cheilocystidia.

Agaricus arorae sp. nov.

Fig. e.

Pileus 3-10 cm latus, convexus demum subplanus, undulatus, fibrilloso-squamulosus, fuscus vel olivaceus, sub fibrillis pallidus; contextus ex albo rufescens; odor mitis, suavis; stipes 5-11 cm longus, 0.7-1.2 cm crassus, deorsum 1.5-3 cm crassus, bulbosus, reliquias velorum praebens, e farcto cavus; vela alba, pendentia; spora (4.1-) 4.5-4.7 (-5.6) x (3.0-) 3.3-3.4 (-3.8) μm ; basidia 20-24 x 6 μm , tetraspora; cheilocystidia 14-25 x 6-13.5 μm , clavata, late clavata vel pyriforma. Holotypus: R. W. Kerrigan 1199, Capitola Extension, Santa Cruz Co., California. 25 November 1981. SFSU.

PILEUS 3-10 cm broad, convex, becoming broadly convex to hemispherical, finally plane, undulating; surface dry, fibrillose, later with small (ca. 2-4 x 1-2 mm) appressed fascicles of fibrils (scarcely squamules) with tips which may recurve in age, colored medium dark brown, "Sayal Brown" to "Tawny-Olive;" background color whitish, becoming sordid; context white, reddening (variably so) when cut, semi-firm, 4-7 mm thick, odor fruity/spicy upon exposure, almond-like with KOH.

LAMELLAE free, close, to 5 mm broad, when young dull pinkish, bruising more rosy color, later dull blackish brown, margin concolorous.

STIPE 5-11 cm long x 7-12 (-17) mm above, 15-30 mm at base, slender, bulbous; interior white, moderately to semi-strongly rufescent upon exposure, somewhat lustrous, stuffed-hollow; surface white, coloring as the interior when bruised, finely striate and lustrous above where not covered by extensive, thin velar zones which remain white as surface darkens, glabrous below, with 0-3 thicker, white (occasionally brown-tipped) scale-like rings; base rather deeply rooted in substrate.

VEILS forming a thin, pendant, supramedian, white annulus with blunt, entire margin, partial veil and universal veil indistinguishable, also leaving remnants on stipe as described above.

SPORES (4.1-) 4.5-4.7 (-5.6) x (3.0-) 3.3-3.4 (-3.8) μ m, dark brown, ellipsoid, hilar appendix not prominent, germ pore not evident. BASIDIA 20-24 x 6 μ m, clavate, tetrasporic; sterigmata 2-3 μ m long. CHEILOCYSTIDIA 14-25 x 6-13.5 μ m, basidiole-like or more broadly clavate, to pyriform, uncommon to common and almost continuous, with scattered basidia on lamellar margin. PILEIPELLIS primarily of interwoven, much-branching, smooth, thin-walled hyphae, appearing very light brown under oil at 1000x, cells 6-9 (-14) x 18-48 μ m, cylindrical or slightly constricted at the septae.

CHEMICAL REACTIONS: KOH yellow; aniline x HNO_3 orange-red within one minute.

Gregarious and caespitose in deep litter of Quercus, sometimes in conjunction with other trees such as Pseudotsuga. Known only from Santa Cruz County, California. Nov. Rare.

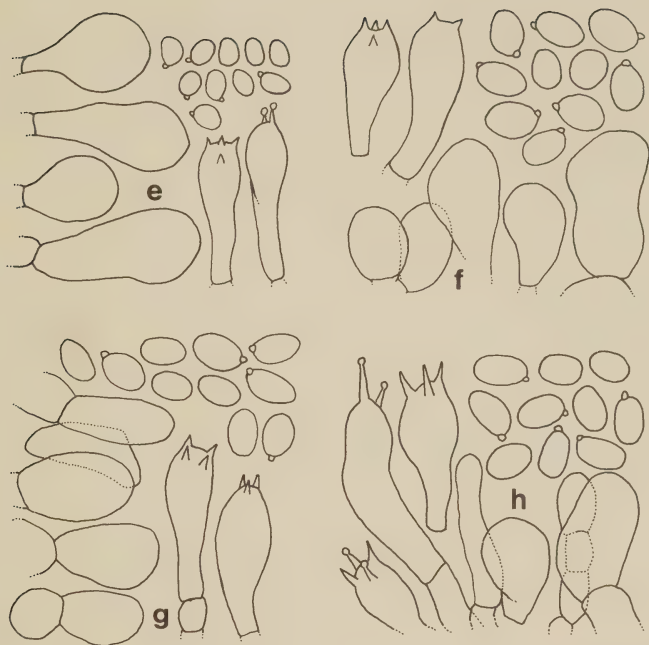
Material studied: CALIFORNIA. Santa Cruz Co.: R. W. Kerrigan 1180, 1199 (holotype).

Observations: The brown color of the pileus, slender stature, and rufescent context are common to many species of Agaricus, such as A. fuscofibrillosus (Møll.) Møll. A. arorae differs in giving positive reactions with the KOH and aniline x HNO_3 tests. The pale velar patches on the darkening surface of the upper stipe are also distinctive. It is placed in section Spissicaules (Heinem.) Kerrigan because of the combination of chemical reactions and rufescence of the context. A. arorae is named for D. Arora, who first brought specimens of this and other interesting species to me.

Agaricus smithii sp. nov.

Fig. f.

Pileus 8-13 cm latus, anguste convexus dein hemisphaericus demum planus, appresso-fibrillosus vel squamulosus, ochraceo-aurantiacus; contextus albus, immutabilis; odor amygdalinus; stipes 7-15 cm longus, 1-1.5



Figs. e-h. Basidia, basidiospores, and cheilocystidia of *Agaricus* spp. e. *A. arorae*, Kerrigan 1180, 1199. f. *A. smithii*, Thiers 24356. g. *A. summensis*, Kerrigan 661, 662. h. *A. perobscurus*, Kerrigan 643. All x 900.

cm crassus, deorsum 2-4 cm crassus, bulbosus vel abrupte bulbosus, e farcto cavus, albus demum lutescens; vela alba, pendentia; sporae (6.4-) 7.4-8.3 (-9.8) x (4.5-) 5.0-5.6 (-6.4) μ m; basidia 18-24 x 9-10.5 μ m, tetraspora; cheilocystidia 9-22.5 x 7.5-13.5 μ m, clavata, ovoidea, vel globosa. Holotypus: H. D. Thiers 21494, Patrick's Point State Park, Humboldt Co., California. 12 November 1967. SFSU.

PILEUS 8-13 cm broad, narrowly convex becoming broadly convex, finally plane; surface dry, appressed-fibrillose becoming minutely appressed-squamulose, the squamules ca. 2-3 mm long x 1-2 mm broad, pointed, colored orangish, near "Tawny," background pallid, generally becoming yellowish-orange; context white, unchanging, to 1.5 cm thick, odor almond-like.

LAMELLAE free, close, to 1 cm broad, dull pinkish becoming greyish, finally dark blackish brown, margin pallid.

STIPE 7-15 cm long x 1-1.5 cm above, 2-4 cm at base, bulbous or more often abruptly bulbous; interior white, or yellowish near base, unchanging, stuffed-hollow, to hollow in age; surface glabrous above, covered below when young with a continuous layer of velar fibrils, white, becoming yellow; base shallowly rooted in substrate, with many yellowish mycelial strands.

VEILS forming an ample, pendant (or pendant-upturned), subapical to supramedian, white annulus; partial veil entire, smooth above, 1-2 mm thick; universal veil typically fissuring radially near margin to form a "cog-wheel" with obtuse points that may become tawny, also leaving deciduous fibrils over entire lower stipe.

SPORES (6.4-) 7.4-8.3 (-9.8) x (4.5-) 5.0-5.6 (-6.4) μ m, dark brown, ellipsoid, hilar appendix rather prominent, germ pore not evident. BASIDIA 18-24 x 9-10.5 μ m, mostly clavate, tetrasporic; sterigmata 2-4 μ m long. CHEILOCYSTIDIA 9-22.5 x 7.5-13.5 μ m, basidiole-like or globose to ovoid or irregular, in scattered clusters, basidia also present on lamellar margin. PILEIPELLIS of sub-parallel to interwoven, smooth, thin-walled hyphae, appearing hyaline under oil at 1000x, cells 4-9 x 27-100 (-175) μ m, cylindrical or constricted at septae, some with swellings to 17 μ m broad.

CHEMICAL REACTIONS: KOH yellow; aniline x HNO_3 quickly orange to scarlet; 2,4-dinitrophenylhydrazine orange within 10 sec; o-tolidine quickly blue everywhere.

Solitary to gregarious under mixed conifers. Known from Mendocino County, California north along the coast into Oregon. Oct. - Nov. (-Jan.). Common in Humboldt County.

Material studied: CALIFORNIA. Del Norte Co.: H. D. Thiers 21342; D. Showers 20 Oct. 1972. Humboldt Co.: R. W. Kerrigan 748-751, 762, 763, 767, 772, 1118; H. D. Thiers 21342, 21372, 21494 (holotype), 24356, 24403, 30316, 40373, 41682, 43837. Mendocino Co.: R. W. Kerrigan 582, 815; H. D. Thiers 40475, 43801.

Observations: Except for the orangish pigment in the pileipellis, A. smithii might be mistaken in the field for the abruptly-bulbous form of A. silvicola (Vitt.) Pk. The much larger spores of A. smithii also permit separation of the above two species.

This species is named for Dr. A. H. Smith, who first (1940) called attention to the existence of this mushroom under the name A. perrarus Schulz., a European fungus. Most modern European authors treat A. perrarus as a synonym of, or a color variant of, A. augustus Fr. Smith, however, showed that his material was clearly different from A. augustus, therefore a new name is necessary for this apparently endemic species.

Agaricus summensis sp. nov.

Fig. g.

Pileus 15-20 cm latus, hemisphaericus demum subplanus, undulatus, appresso-fibrillosus; fibrillae ochraceae; contextus albus, immutabilis, odor amygdalinus; stipes 11-18 cm longus, 3 cm crassus, deorsum 4.5-5 cm crassus, clavatus, e farcto cavus, albus dein lutescens; vela alba, pendientia; sporae (5.6-6.0-) 6.7-7.2 (-8.3-9.0) x (3.4-4.1-) 4.4-4.6 (-5.3) μ m; basidia 19-24 x 7-8 μ m, tetraspora; cheilocystidia 12-18 x 5.5-11 μ m, ellipsoidea vel cylindrica. Holotypus: R. W. Kerrigan 661, Castle Rock State Park, Santa Clara Co., California. 6 March 1977. SFSU.

PILEUS 15-20 cm broad, hemispherical becoming broadly convex or somewhat truncate, finally semi-plane, undulating, margin often splitting; surface dry, appressed-fibrillose, the fibrils ca. 10 mm long, colored yellowish becoming ochraceous, near "Ochraceous-Tawny;" background color whitish; context white, unchanging, firm, to 2 cm thick, odor almond-like.

LAMELLAE free, close, to 1.5 cm broad, pallid, sometimes becoming slightly pinkish, finally dark blackish brown.

STIPE 11-18 cm long x 3 cm above, 4.5-5 cm below, clavate or occasionally bulbous; interior white, or yellowish near base, unchanging, slightly lustrous, narrowly stuffed-hollow; surface glabrous, or with scant, obscure fibrils below, white becoming buffy-yellowish; base rather deeply rooted in substrate.

VEILS forming a white, subapical to supramedian, pendant annulus, dehiscing from pileus margin late during expansion, then collapsing; upper surface (partial veil) rugose; lower surface (universal veil) breaking up via radial fissures into broad, somewhat obscure, rough-surfaced patches, also sometimes leaving scant floccules on surface of lower stipe.

SPORES (5.6-6.0-) 6.7-7.2 (-8.3-9.0) x (3.4-4.1-) 4.4-4.6 (-5.3) μ m, dark brown, ellipsoid, hilar appendix not prominent, germ pore not evident. BASIDIA 19-24 x 7-8 μ m, clavate, tetrasporic; sterigmata 2-4 μ m long. CHEILOCYSTIDIA 12-18 x 5.5-11 μ m, ellipsoid, cylindrical, or irregular, occurring in clusters, narrow hyphae oriented parallel to lamellar margin also present. PILEIPELLIS of parallel, smooth, thin-walled, hyaline hyphae, cells 2.5-6 (-10.5) x 65-180 μ m, cylindrical.

CHEMICAL REACTIONS: KOH yellow; aniline x HNO_3 quickly scarlet.

Solitary or in pairs, in litter of Pseudotsuga (with Quercus present or not) and apparently also under Sequoia, on slopes or summits of the Coast Range in the San Francisco Bay region. (Dec.-) Jan. - Mar. Rare.

Material studied: CALIFORNIA. Marin Co.: R. W. Kerrigan 1210. Alameda Co.: R. W. Kerrigan 971. Santa Clara Co.: R. W. Kerrigan 661 (holotype), 662.

Observations: The large size, ochraceus, fibrillose pileus and spore size distinguish A. summensis. It might be mistaken in the field for a very robust specimen of A. silvicola which had discolored in age; however the tawny color of the pileus fibrils in A. summensis appears to be due to the presence of a true pigment in the hyphae of the pileipellis. The fibrils can, however, be indistinct, and the pigment may be slow to develop. The spores of A. summensis are longer than those of A. silvicola and other similar species. The European A. fissuratus (Møll.) Møll. has a very similar aspect, but has larger spores, a pastoral, maritime habitat, and apparently can discolor but lacks pigmentation in the pileus.

Agaricus perobscurus sp. nov.

Fig. h.

Pileus 8-17 cm latus, hemisphaericus vel subtruncatus demum planus, appresso-fibrillosus vel squamulosus, perobscurus fuscus, sub fibrillis albidus vel subaurantius; contextus albus, immutabilis; odor amygdalinus; stipes 8-13 cm longus, 1.4-2.5 cm crassus, deorsum 2.5-3.5 cm crassus, bulbosus, e farcto cavus; vena pendentia, alba, tenuia; sporae (5.3-) 6.4-7.4 (-9.0) x (3.8-4.1-) 4.3-4.7 (-6.0) μ m; basidia 17-30 x 7.5-9 μ m, tetraspora; cheilocystidia 9-20 x 7-15 μ m, clavata, oblonga, vel subglobosa, interdum catenulata. Holotypus: H. D. Thiers 19004, Sunset Avenue, San Francisco Co., California. 24 April 1967. SFSU.

PILEUS 8-17 cm broad, at first hemispherical to convex, later often somewhat truncate with a broad disc, finally plane; surface of appressed fibrils which in age form small (ca. 3-5 mm long x 1-3 mm broad), pointed to slightly areolate, appressed-fibrillose squamules colored dark brown, "Olive-Brown" to "Clove Brown" or "Fuscous," or in age about "Sayal Brown;" background color usually predominating after expansion, at first whitish to "Pale Vinaceous-Fawn," in age becoming somewhat "Light Ochraceous-Salmon" to "Cinnamon-Beige," then surface often appearing somewhat polished; context white, unchanging, 1-2 cm thick, odor faintly to moderately of almonds.

LAMELLAE free, close, to 1 cm broad, at first pallid, then "Pinkish Beige" or "Fawn Color," later dark blackish brown, margin pallid.

STIPE 8-13 cm long x 1.4-2.5 cm broad above, 2.5-3.5 cm at the bulbous base; interior white, unchanging or becoming somewhat yellow below, slightly lustrous, stuffed-hollow; surface glabrous above, with thin appressed-fibrillose velar zones below, white, in age often appearing smooth, polished; base shallowly rooted in well-decomposed leaf/needle litter.

VEILS forming a thin, entire, pendant, subapical to supramedian, white annulus composed mainly of partial veil, upper surface nearly smooth; universal veil present as thin marginal patches colored medium brown, "Avellaneous" to dark brown, "Fuscous" on the minutely fibrous to rimose-floccose whitish or later orangish undersurface of annulus, also leaving white to greyish, "Clay Color" velar zones on lower stipe.

SPORES (5.3-) 6.4-7.4 (-9.0) x (3.8-4.1-) 4.3-4.7 (-6.0) μm , dark brown, ellipsoid to elongate, hilar appendix not prominent, germ pore not evident. BASIDIA 17-30 x 7.5-9 μm , clavate or cylindroclavate, tetrasporic; sterigmata 3-6 μm long. CHEILOCYSTIDIA 9-20 x 7-15 μm , basidiole-like or oblong to subglobose, rarely catenulate, in scattered clusters, lamellar margin also composed of basidia and narrow hyphae oriented parallel to margin. PILEIPELLIS of parallel or sub-parallel to interwoven, smooth, thin-walled hyphae, appearing light brown under oil at 1000x, cells 6.5-9 (-12) μm x 35-80 (or more in age) μm , cylindrical or constricted at the septae.

CHEMICAL REACTIONS: KOH yellow; aniline x HNO_3 slowly or quickly orange to scarlet; 2,4-dinitrophenylhydrazine orange-red in 10 sec; o-tolidine quickly blue everywhere, becoming reddish-black on context.

Solitary to gregarious in litter/soil under various (usually planted) trees, fairly common under Cupressus macrocarpa, occasional under Pinus, Quercus, Eucalyptus, and perhaps others, in the San Francisco Bay region and possibly southern California as well. Dec. - Apr.

Material studied: CALIFORNIA. Marin Co.: R. W. Kerrigan 883. San Francisco Co.: R. W. Kerrigan 593, 643, 650, 670, 855, 920, 954; H. D. Thiers 19004 (holotype). San Mateo Co.: R. W. Kerrigan 942, 943, 967.

Observations: Agaricus perobscurus may be confused with A. augustus in the field; however the pileus of A. perobscurus is generally darker when young, and more pallid and polished when old, than that of the latter species. The thinner annulus, more scant fibrils on the stipe, and frequently pink lamellae of A. perobscurus are also good field characters which contrast with the corresponding features of A. augustus. The spores of the former species are much smaller than those of the latter. Agaricus subrufescentoides Murr., which is perhaps only a dark form of A. hondensis, is another fungus with a similar aspect which is seldom encountered in California but is more common further north; unlike A. perobscurus it has a negative aniline x HNO_3 reaction and a phenolic odor.

ACKNOWLEDGMENTS

I am deeply grateful to Dr. Harry D. Thiers for the years of patient encouragement and advice which he has so generously given to me, and additionally for his critical comments on this manuscript. I also thank Mrs. Ellen Thiers for rendering the diagnoses into Latin, and for her advice on this subject, Dr. David Farr of the National Fungus Collections for searching for prior synonyms of the above new combinations, and Dr. Clark Rogerson and Dr. Rupert Barneby of the New York Botanical Garden for suggesting the epithet "rubronanus." Finally, I am indebted to many collectors, amateur, student, and professional, who helped to bring to my attention certain of the collections and data mentioned above.

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MORE COMMENTS ON THE GENUS ACERVUS

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Several years ago, the senior author (Pfister 1975) proposed an emendation of the genus *Acervus* Kanouse and presented results of studies on the development of *A. flavidus* (Berk. & Curt. in Berk.) Pfister. At that time he had not seen living material of *A. epispartius* (Berk. & Br.) Pfister which, though described from the Americas and Asia, appeared to be only rarely collected. Recently, the junior author made a large collection of *A. epispartius* in Utica, New York, which allows further comment on the species. The following is presented by way of review.

ACERVUS Kanouse emend. Pfister (1975)

= *Acervus* Kanouse, Pap. Michigan Acad. Sci. 23: 149. 1938.

= *Phaetropezia* Le Gal, Prodr. Flore Mycol. Madagascar 4: 179. 1953.

Apothecia up to 1.5 cm in diam, at maturity plane but when young, shallow cupulate. Hymenium bright yellow to orange; outer surface of the apothecium concolorous or only slightly paler. The apothecia often occur in clusters or groups on soil and debris. The mycelium tends to bind together the substrate to form dense mats. The excipulum is composed of interwoven hyphae. The medullary excipulum is of hyphae which are widely spaced and there are occasional swollen cells. Toward the outer surface of the apothecia, the interwoven hyphae become densely interwoven and form an indistinct layer of *textura angularis*. The asci are small with an indistinct dehiscence mechanism; the

ascospores are small, reaching a length of 13 μm in one species. The ascospores are ellipsoid with somewhat blunt ends and are in a single row within the ascus. Pfister (1972), showed that the ascospores are uninucleate. Paraphyses are simple and neither branch nor anastomose, the bright yellow to orange pigments in the paraphyses are soluble in water and alcohol.

ACERVUS EPISPARTIUS (Berk. & Br.) Pfister, Occ. Pap. Farlow Herb. 8:3. 1975.

- = *Peziza epispertia* Berk. & Br., J. Linn. Soc., Bot. 14:103. 1873.
 - = *Phialea epispertia* (Berk. & Br.) Pat., Bull. Soc. Mycol. France 29:221. 1913.
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- = *Peziza flavotingens* Berk. & Br., J. Linn. Soc., Bot. 14: 104. 1873.
 - = *Humaria flavotingens* (Berk. & Br.) Sacc., Syll. Fung. 8:129. 1889.
 - = *Phaedropezia flavotingens* (Berk. & Br.) Le Gal, Bull. Jard. Bot. État 29:96. 1959.
- = *Peziza radiculosa* Berk. & Br., J. Linn. Soc., Bot. 14:103. 1873.
 - = *Sarcoscypha radiculosa* (Berk. & Br.) Sacc., Syll. Fung. 8:155. 1889.
- = *Peziza microspora* Berk. & Curt. in Berk., Grevillea 3:150. 1875.
 - = *Humaria microspora* (Berk. & Curt. in Berk.) Sacc., Syll. Fung. 8:131. 1889.
- = *Acervus aurantiacus* Kanouse, Pap. Michigan Acad. Sci. 23:149. 1937 [1938].

For descriptions, see Kanouse (1937), Le Gal (1953), Korf (1963). Pfister (1975) provides a general commentary on *A. epispertius*. The features which distinguish *A. epispertius* from *A. flavidus* are the thin-walled ascospores which are 5.8 - 7.5 x 3.2 - 4 μm which are regular in outline.

A. epispertius has been collected in Argentina, Ceylon, Africa, Madagascar, Malaya, Vietnam, and the United States, and, as can be seen from the synonyms, it has often been described as new. The previous other North American collections were the holotype of *Acervus aurantiacus*, on soil around roots of an elm tree in a bog, South Lyons, Michigan (MICH), on loose decaying rubbish, Philadelphia (NY), and the holotype of *Peziza microspora*, on damp,

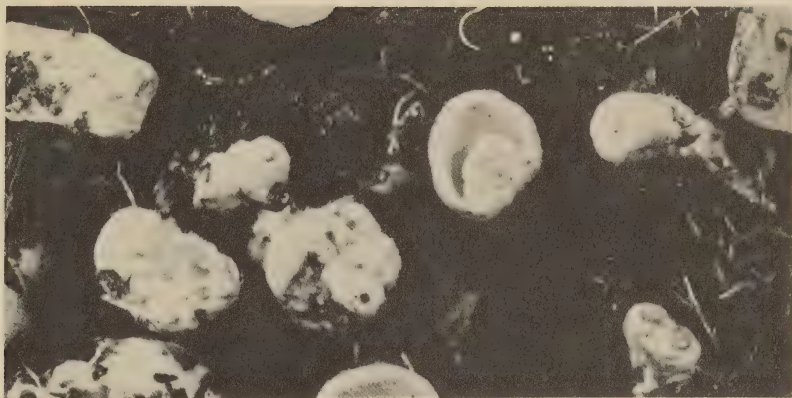


Figure 1. Photograph of ascocarp primordia at various stages of maturation; the primordium at center shows the "flap-like" covering.

rotten wood near the ground, South Carolina (K). The collection from Utica was made on a mixture of wood chips, hay and dung where it occurred in great masses (FH). Interestingly, at the same time this collection was made, another collection of *A. epispartius* was received via Richard P. Korf from Florida collected by J. W. Kimbrough. This collection was made on soil in grass under a laurel oak in Gainesville. Though a small collection, it agrees with the Utica collection in anatomical detail.

The Utica collection has allowed us to determine that the pattern of apothecial development in this species is identical to that already observed in the other species, *A. flavidus* (Pfister, 1975). Basically the ascocarps of *A. epispartius* are cleistohymenial, opening at the prothymenial stage. The developmental stages are illustrated in figure 1. The earliest primordia are somewhat flattened globular structures which show a slightly indented ring-like structure distally. As the ascocarps expand, the indented ring separates from the surrounding material and a flap of tissue is torn out and is thrown to one side. Pfister (1975) indicated that, from field notes made by E. J. H. Corner accompanying specimens at BPI, similar observations could be deduced but now we are able to substantiate the occurrence. This type of development has not been observed elsewhere in the Pezizales so far as we are aware.

In the original description of *Acervus aurantiacus* Kanouse (1937) mentioned that the apothecia arose "from a black, tough, rubbery sclerotiform base composed of

thin-walled mycelium intermingled with debris." The structures have not been observed in any of the specimens examined and were not found in the collection made in Utica. Both species of *Acervus* occur on soil and loose rubble and it is possible that the holotype of *A. aurantiacus* was growing upon some substrate which was itself rubbery. The collection of *A. epispartius* from Utica was growing on debris mixed in dung--a substrate not previously recorded for these species.

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VALIDATION OF *AMANITA LONGIPES*

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Summary

Amanita longipes (fig. 1), provisionally described by Bas (1969), is described and illustrated from the Pine Barrens of New Jersey and eastern Long Island, New York. A collection is also reported from northcentral Alabama.

Introduction

Bas (1969) described *Amanita longipes* from a single specimen collected in Port Jefferson, Suffolk County, New York by Charles H. Peck in August, 1906 (NYS). The specimen studied, along with its label, were found in the same box with *Amanita limbatula* Bas. There were no field notes associated with this single specimen. Bas assumed that this specimen must have been whitish, since it was placed in the box with *Amanita limbatula*, described as being whitish.

Due to the lack of field notes and the fact that he was only able to examine one specimen, Bas described *Amanita longipes* as a provisional name.

Amanita longipes Bas in Tulloss & Jenkins, sp. nov.

Holotypus: New York, Suffolk County, Flanders, A. Norarevian 8-12-82-AN3 (NY).

Pileus albus, pallidus, canior-fuscus, vel canior-luteus super orbem ut pileus senescit, 24-81 mm in mensura diametrica; primo hemisphaericus, sed deinde qui fit late convexus cum margine incurvata, cuius summa fit fulgens, non-striatus, appendiculatus; contextus albus; materies volvica alba, densa, tenuiter pulverulenta-flocculosa, non-numquam magna ex parte evanescens ut senescit. Interdum potest canior vel fusior in orbe fieri. Lamellae albiore; densae; angustae; anguste adnatae ad adnatas; aliquando cum linea decurrenti. Lamellae fiunt caniores et gilvae cum siccentur. Residua flocculosa veli imperfecti in margine; lamellulae copiosae-rotundatae truncatae usque ad attenuates. Stipes albus 25-142 x 5-20 mm, flocculosus, praeterea in parte

NYS - Herbarium of the New York State Museum

NY - Herbarium of The New York Botanical Garden

superiori; facile sublatus; fastigatus adversus cacumen; dilatatus, solidus vel cum lumine firmiter farto; subradicans vel radicans, et denque cum bulbo radicali dauciformi vel anguste oblongo, 22-72 x 8.5-27 μm . Velum non perfectum, fibrosum flocculosum, et rapide evanescens. Leniter odoriferum vel sine odore. Sporae 8.4-17.5(20.3) x 4.2-7.0 (7.7) μm , amyloidei.

PILEUS: 24-81 mm diam, hemispheric at first becoming broadly convex, occasionally slightly depressed in center; white, pallid grayish-brown, or grayish buff over disk in age, surface becoming shiny; pileipellis peeling; margin nonstriate, incurved, appendiculate; context white, one specimen slightly browning where damaged, larvae tunnels not discolored, 3-10 mm thick at center; universal veil dense, finely pulverulent-flocculose, sometimes largely disappearing in age, especially over disk, white or at times grayish or brownish over disk where it infrequently comprises irregular, floccose warts that may darken on tips. LAMELLAE: close, narrow, 4.5-11 mm broad, narrowly adnate to adnate, sometimes with a decurrent line, whitish, becoming grayish-cream on drying, with white, floccose remnants of partial veil on edges; lamellulae plentiful, rounded truncate to attenuate. STIPE: white, 25-142 x 5-20 mm, tapering upwards slightly with flaring apex, floccose especially in upper portion, material easily removed, solid or with firmly stuffed central cylinder, up to 7 mm diam; context white, occasionally graying in damaged areas, no discoloration in larvae tunnels, easily breaking up into fibers; basal bulb subradicate or radicate, rarely narrowly oblong or subclavate, 22-72 x 8.5-27 mm, sometimes with brick red or rusty stains or spots, frequently flattened or doglegged; partial veil fibrous-floccose and rapidly evanescent. Having no distinct odor or, rarely, faintly odorous (as of disinfectant). No bruising of flesh noted, except in one specimen (7-30-82-C) in which handling seemed to leave a faintly pinkish bruise. Phenol spot tests were positive for tyrosinase (Marr, 1979). Other spot tests (FeSO_4 , NH_4OH , KOH, formalin) were all negative.

PILEIPELLIS: two layers about 130 μm thick, suprapellis an ixocutis, gelatinizing, subpellis of nongelatinizing, interwoven hyphae, 1.4-4.2 μm diam; oleiferous hyphae plentiful, branching, up to 9.1 μm diam. PILEUS TRAMA: inflated cells abundant, terminal, broadly ellipsoid, up to 77 x 43 μm , to slender bacilliform, up to 180 x 30 μm ; filamentous, undifferentiated hyphae 3.5-4.2 μm diam, no clamps seen. LAMELLA TRAMA: bilateral; oleiferous hyphae plentiful; inflated cells slender, up to 170 x 28 μm ; filamentous, undifferentiated hyphae up to 5 μm diam. SUBHYMENIUM: inflated ramose to subcellular. BASIDIA: 45-60(70) x 9.5-14 μm , 4-spored, thin-walled, no clamps seen. UNIVERSAL VEIL: on pileus dominated by globose to broadly ellipsoid cells without apparent order, up to 78 x 71 μm , with pyriform, clavate and fusiform cells, up to 94 x 31 μm ; relatively few filamentous, undifferentiated hyphae; oleiferous hyphae fairly conspicuous. PARTIAL VEIL: dominated by globose to bacilliform inflated cells, up to 85 x 30 μm ; few undifferentiated, filamentous hyphae, 2.8-7.7 μm diam; oleiferous hyphae present. STIPE TRAMA: terminal cells slender, erect, narrowly clavate, up to 285 x 32 μm ; oleiferous hyphae moderately abundant to abundant; no clamps seen. All tissues pale yellow in 10% KOH except as noted.

BASIDIOSPORES: (600 from 30 specimens) 8.4-17.5(20.3) x 4.2-7.0 (7.7) μm , (avg. length/specimen = (10.4)10.8-12.5(12.9) μm ; avg. length (all specimens) = 11.9 μm ; avg. width/specimen = 4.8-5.9 μm ; avg. width (all specimens) = 5.4 μm), ($\bar{E}$ = (1.5)1.6-3.0(3.5); $\bar{E}^m$ = 1.92-2.51,

avg. 2.23), amyloid, cylindric, occasionally elongate, rarely ellipsoid, occasionally constricted, may be expanded at one end; contents guttulate; apiculus sublateral; white in deposit.

Habitat and distribution: solitary to gregarious to subcaespitose in loose, sandy soil under *Quercus* spp., including *Q. ilicifolia* Wangenh. and *Q. marilandica* Muenchh. and *Pinus* spp., predominately *P. rigida* Mill. in eastern Suffolk County, Long Island, New York and the New Jersey Pine Barrens where it has been found as early as July 8 and as late as October 2. In Alabama *A. longipes* has been found in mixed woods, including *Pinus taeda* and *Quercus* spp.

Collections examined: ALABAMA - border of Shelby & Jefferson Counties, 21. viii. 84, C. Bas & D. T. Jenkins 2538(DTJ). NEW JERSEY - Burlington County, Lebanon State Forest, M. King & R. Tulloss 8-15-82-A, 9-11-83-A, members of the N.J. Myc. Assoc. 8-15-82-B; Middlesex County, Helmetta, R. Tulloss 8-12-81-F, 8-12-81-G, 7-30-82-C, 8-18-83-E, 8-18-83-G, 8-18-83-H, R. & D. Tulloss 9-3-83-F, R. & M. Tulloss 8-2-83-E, 8-2-83-F, R. & M. & D. Tulloss 9-18-82-E, R. & D. Tulloss & M. King 8-7-83-A, 8-7-83-B (SIU), A. Norarevian & D. Patterson 8-1-82 AN1, 8-1-82-AN2; Ocean County, Lakehurst, R. Tulloss 9-11-82-S; NEW YORK - Suffolk County, Flanders, A. Norarevian 8-12-82-AN1, 8-12-82-AN2(DTJ), 8-12-82-AN3(NY) Type, 8-12-82-AN6; Flanders, A. Norarevian 8-12-82-AN4; Riverhead, A. Norarevian 8-12-82-AN5.



Fig. 1 *Amanita longipes* (8-2-83-F [x0.7], 8-12-81-F [x0.6], 8-15-82-B [x0.7])

DISCUSSION

Bas (1969) considers this organism to be closely related to members of stirps *Chlorinosma*, although the latter has clamps on the

basidia whereas *A. longipes* does not. He also states that there is a strong resemblance to *A. pelioma* in stirps *Cinereoconia*. *Amanita pelioma*, however, is usually slightly grayish in color and has more abundant hyphae in the volva. Because of the above mentioned differences Bas has placed this organism in stirps *Longipes*, section *Lepidella*.

Our description expands that of Bas which is based upon a dried specimen without field notes. The two descriptions agree except in two particulars: the width of the basidiospores and the basidia. In both cases the measurements in the upper range are recorded by Bas(1969).

The New York and New Jersey collections were compared by computing E^m values for 105 basidiospores from 7 Suffolk County specimens (2.22) and E^m values for 495 basidiospores from 23 New Jersey specimens (2.23). Bas measured 20 spores with an average length/breadth of 1.8, below the values for any basidiocarp we examined. One of our specimens (7-30-82-C) produced basidiospore measurements with a distribution having a median width as high as that recorded by Bas. Indeed, were Bas' range of length expanded by 0.5 μ m in both upper and lower bounds and breadth expanded by 0.5 μ m in its lower bound, then all 50 basidiospores measured for the collection would fall in the extended range. This observation led to examination of the effect of a similar expansion of Bas' ranges in relation to all 600 basidiospores measured. As a result, 96% fell within the extended size range. It is possible that dry Augusts in 1981-1983 may have contributed to a slight narrowing of the spores in the collections we examined.

Bas described stirps *Longipes* as the clampless analog of stirps *Chlorinosma*. In the field, *A. longipes* differs from *A. chlorinosma* (Austin) Lloyd mostly by its smaller habit and greater degree of radiating in the frequently curved or doglegged stipe. The densely floccose *A. longipes* appears to be much more common than *A. chlorinosma* in the sandy oak and pine woods of Long Island and the New Jersey Pine Barrens. Very small, deeply radiating specimens might be confused with *A. onusta* (Howe) Sacc. in the field. However, the volval material of *A. longipes* is always much paler than that of *A. onusta* and usually much more floccose.

ACKNOWLEDGEMENTS

We thank Mr. Aaron Norarevian, Glen Oaks, New York for directing R. Tulloss to the collecting site at Helmetta, New Jersey and providing all of the New York collections. We also thank Dr. Joseph Ammirati for reviewing this paper. The drawings are by Mr. Neal Macdonald, Princeton, New Jersey.

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ETUDE DES GRANULATIONS SIDEROPHILES DU GENRE *MELANOLEUCA* (AGARICALES)*

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Résumé:

Les granulations sidérophiles des basides de dix espèces du genre *Melanoleuca* sont étudiées en microscopie photonique et électronique à transmission.

Summary:

The siderophilous granulations of basidia of ten species of the genus *Melanoleuca* are studied in photonic and transmission electronic microscopy.

I: INTRODUCTION

Kühner (1938) a remarqué pour la première fois la présence de granulations sidérophiles dans les basides des espèces des genres *Lyophyllum* et *Calocybe*. La structure de ces granulations -contenant des protéines basiques et capables de se lier à de nombreux ions métalliques- a été élucidée par Cléménçon (1967). Par la suite, Cléménçon (1978) a proposé une classification de ces granulations fondée sur leurs distributions et leurs morphologies. En 1980 Sathe et Daniel ont créé le nouveau genre *Lyophyllopsis*. Nous n'avons pas pu examiner l'holotype de ce genre, trop mal conservé, mais A. V. Sathe nous a indiqué qu'il s'agissait d'une espèce du genre *Melanoleuca* dont les basides présentaient des granulations sidérophiles.

*Ce travail entre dans le cadre de la préparation d'une thèse de doctorat à l'Université de Lausanne.

A la lumière de ces travaux, nous poursuivons, dans un but taxonomique, l'étude de la structure et de l'ultrastructure des basides de quelques unes des espèces du genre Melanoleuca.

II: MATERIEL ET METHODES:

1. Matériel examiné:

No. d'	<u>Melanoleuca</u> :	appartient
herbier		à la section:
(LAU):		

HC 79-2	<u>decembris</u> Métrod	Acystidiace
JP 82-19	<u>subalpina</u> (Britz.) Bres. & Stangl	Alboflavidae
JP 82-21	<u>excissa</u> (Fr.) Singer	Grammopodiace
JP 82-41	<u>subpulverulenta</u> (Pers.) Singer	Strictipedes
JP 84-6	<u>rasilis</u> (Fr.) Singer	Grammopodiace
JP 84-7	<u>microcephala</u> (Karsten) Singer	Grammopodiace
JP 84-11	<u>oreina</u> (Fr.) Kühner & Maire	Melanoleuca
JP 84-12	<u>phaeopodia</u> (Bull.:Fr.) Murrill	Melanoleuca
JP 84-17	<u>arcuata</u> (Fr.) Singer	Cognatae
JP 84-20	<u>verrucipes</u> (Fr.) Singer	Humiles

2. Méthodes:

La méthode de préparation et de coloration du matériel observé en microscopie photonique a été décrite par Cléménçon (1978). La fixation du matériel examiné en microscopie électronique à transmission est réalisée en prélevant un secteur du chapeau d'un champignon frais qui est fixé par immersion pendant 15 à 20 min. dans une solution composée en quantité égale d'une part de:

KMnO ₄	2%	1 g.
Tampon Cacodylat HCl	0.05 M (pH=6.9)	2.5 ml.
H ₂ O ad		50 ml.

et d'autre part d'une solution mouillante d'invadine-JFC (Ciba-Geigy, Bâle, Suisse) à 0.3%

Après déshydratation par passage dans différentes concentrations d'acétone (30-50-70-90 %) et finalement dans de l'oxyde de propylène, l'objet est polymérisé puis inclus dans une solution de Spurr (1969).

Les coupes sont réalisées avec un ultramicrotome Reichert Om U2, contrastées par de l'acétate d'uranyle et du citrate de plomb et observées au moyen d'un microscope électronique Hitachi HU 12 à une tension d'accélération de 75 KV.

III: RESULTATS:

Les figures 1 et 2 montrent que de nombreuses granulations sidérophiles sont présentes dans chacune des basides des espèces étudiées. Nous pouvons retrouver et identifier ces granulations sur les microphotographies électroniques des fig. 3, 4 et 5. Selon Clémenton (1978) ces granulations mesurant de 0.1 à 0.3 μm . et distribuées aussi bien à la périphérie que dans la partie centrale du cytoplasme de la cellule sont de type micro. De ce fait, et à cause de la focalisation, elles apparaissent peu distinctement sur les photos prises en microscopie photonique. Nous les avons signalées par des flèches.

IV: DISCUSSION:

Chacune des sections du genre Melanoleuca, telles qu'elles ont été résumées par Bon (1978) sont représentées dans cette étude par un specimen dont les basides contiennent des granulations sidérophiles. La création du nouveau genre Lyophyllopsis au sens de Sathe et Daniel (1980) nous semble donc inappropriée.

V: REMERCIEMENTS:

Je remercie vivement le Professeur Clémenton et le Docteur Keller qui m'ont communiqué leurs remarques et leurs suggestions ainsi que Daisy Calame et les membres du centre de microscopie électronique de l'Université de Lausanne pour leur aide technique.

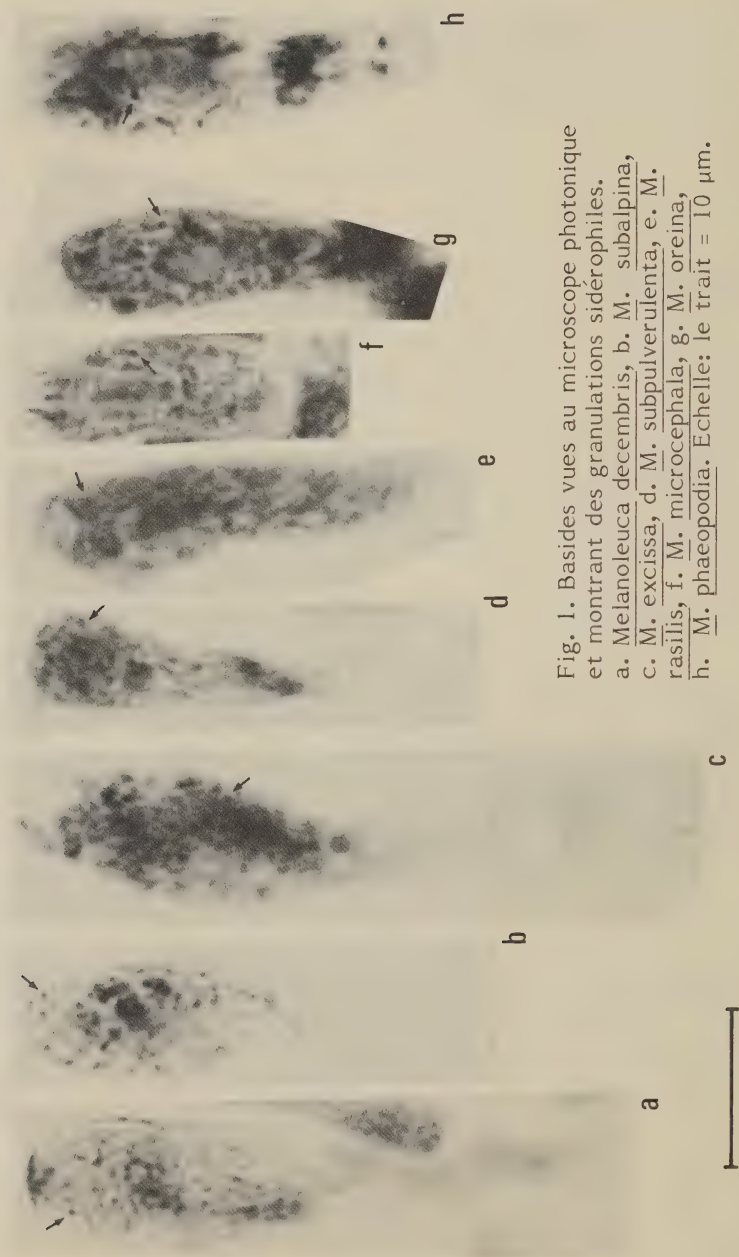
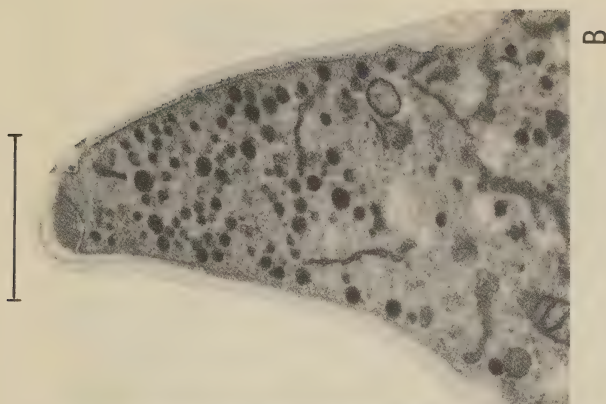


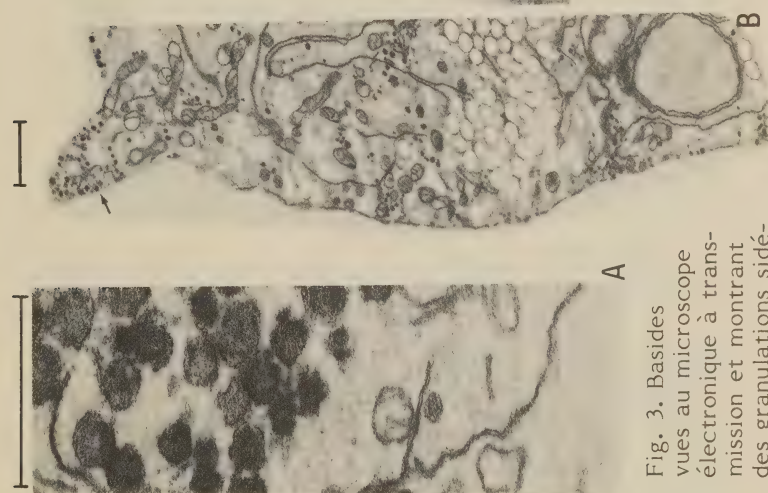
Fig. 1. Basides vues au microscope photonique et montrant des granulations siderophiles.
 a. Melanoleuca decembris, b. M. subalpina, c. M. excissa, d. M. subpulverulenta, e. M. rasilis, f. M. microcephala, g. M. oreina, h. M. phaeopodia. Echelle: le trait = 10 μ m.



B

rophiles. A. Melanoleuca
decembris, B. M. subalpina.

Echelle: le trait = 1 μ m.



A

Fig. 3. Basides
vues au microscope
électronique à trans-
mission et montrant
des granulations sidé-

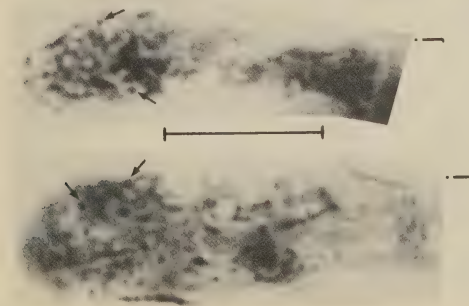


Fig. 2. Basides vues au
microscope photonique et
montrant des granulations
sidérophiles. i. Melanoleuca
arcuata, j. M. verrucipes.
Echelle: le trait = 10 μ m.

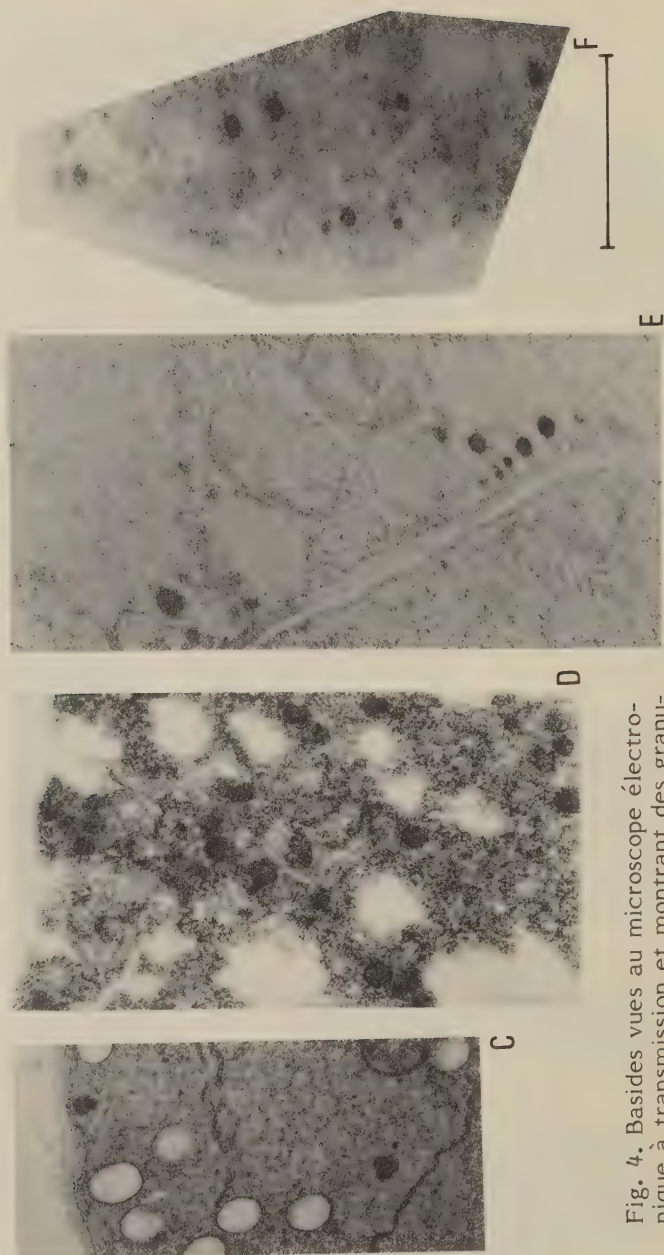


Fig. 4. Basides vues au microscope électronique à transmission et montrant des granulations sidérophiles. C. Melanoleuca excissa, D. M. subpulverulenta, E. M. rasilis, F. M. microcephala. Echelle: le trait = 1 μ m.

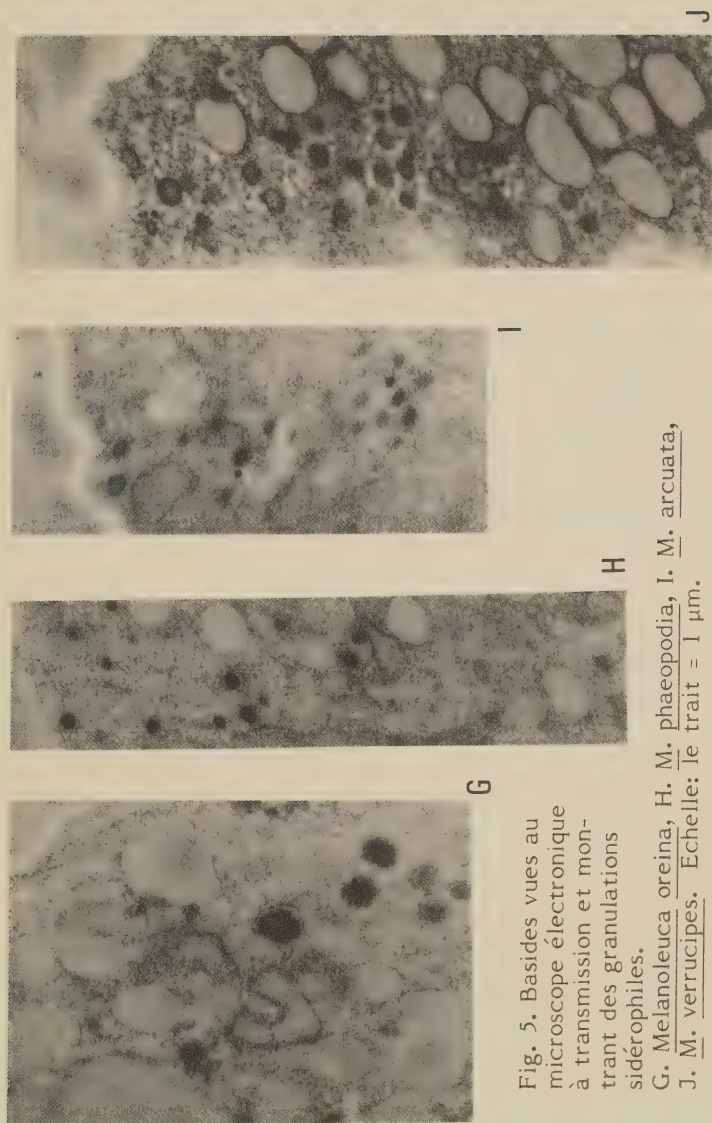


Fig. 5. Basides vues au microscope électronique à transmission et montrant des granulations sidérophiles.

G. Melanoleuca oreina, H. M. phaeopodia, I. M. arcuata, J. M. verrucipes. Echelle: le trait = 1 μ m.

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REVISED LIST AND HOST INDEX OF ARIZONA RUST FUNGI¹

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SUMMARY

Latin names of the Uredinales (plant rust fungi) are arranged alphabetically. There are 235 species and varieties belonging to 26 genera known to occur in Arizona. *Puccinia* with 123 species and *Uromyces* with 33 species exceed the other genera. Host plants include species in 255 genera of native and introduced plants. Angiosperms, especially the families Compositae, Gramineae, and Leguminosae are predominant but ferns and conifers also serve as hosts. Cotton rust (*Puccinia cacabata*) is the most important species, economically. *Frommeella duchesneae* comb. nov. is proposed.

INTRODUCTION

Arizona has a diverse flora comprised of trees, shrubs, herbs, and grasses ranging from the lower Sonoran Desert to subalpine regions. This diversity of host plants and climate supports a large number of plant rust fungi. Recorded in Arizona on native and introduced plants are 235 species and varieties belonging to 26 genera of Uredinales. The morphology and distribution of these fungi are recorded by Arthur (1934), Cummins (1971, 1978, 1979), and León Gallegos and Cummins (1981a,b). Major genera in Arizona are *Puccinia* with 123 species, *Uromyces* with 33 species, and *Gymnosporangium* with 11 species. Other genera are represented by fewer than ten species. Spore states of the fungus found on the host plants are indicated by the symbols 0, I, II, and III, that refer to spermogonia, aecia, uredinia, and telia, respectively. A first Arizona list was published by Gilbertson and McHenry in 1969.

The host plants are distributed in 55 families and 255 genera. Of these, two families, four genera, and four species are ferns (Pteridophyta); three families, seven genera, and 16 species are conifers (Gymnospermae); the remainder are flowering plants (Angiospermae). The families that support the most species of rust fungi are Compositae, Gramineae, Leguminosae, and Rosaceae. Nomenclature of host plants follows Kearney and Peebles (1960), Lehr (1978), and Lehr and Pinkava (1980, 1982). County locations are listed for each host record. An asterisk (*) indicates that the county is not known. County records are given by number as follows: 1, Apache; 2, Cochise; 3, Coconino; 4, Gila; 5, Graham; 6, Greenlee; 7, La Paz; 8, Maricopa; 9, Mohave; 10, Navajo; 11, Pima; 12, Pinal; 13, Santa Cruz; 14, Yavapai; 15, Yuma.

¹ University of Arizona Agricultural Experiment Station Journal
Article No. 4004.

Authorities for names of host plants have been omitted to conserve space.

RUST FUNGI OF ARIZONA WITH HOSTS AND DISTRIBUTION

- AECIDIUM sp. 0,I on *Jatropha macrorrhiza* var. *septemfida* (2).
 AECIDIUM LYCII Arth. 0,I on *Lycium pallidum**.
 ARTHURIOMYCES PECKIANUS (Howe in Peck) Cumm. & Y. Hirat. (*Gymnoconia peckiana* Howe in Peck). 0,I,III on *Rubus loganobaccus* (14).
 CHRYSOMYXA ARCTOSTAPHYLI Diet. 0,I on *Picea engelmannii* (3); *P. pungens* (3); II,III on *Arctostaphylos patula* (3).
 C. PIROLATA Wint. II,III on *Pyrola virens* (2,3,11).
 COLEOSPORIUM ARIZONICUM Cumm. II,III on *Brickellia californica* (3).
 C. ASTERUM (Diet.) Syd. II,III on *Solidago missouriensis* (3).
 C. CROWELLII Cumm. III on *Pinus edulis* (3,14).
 C. IPOMOEAE (Schw.) Burr. 0,I on *Pinus leiophylla* var. *chihuahuana* (2).
 C. JONESII (Peck) Arth. 0,I on *Pinus edulis* (3,14); II,III on *Ribes cereum* (3,11); *R. inebrians* (3,10,14); *R. leptanthum* (3); *R. pinetorum* (1,2,3); *R. velutinum* (3); *R. wolfii* (1).
 C. VIGUIERAE Diet. & Holw. 0,I,III on *Verbesina encelioides* (2); *Viguiera cordifolia* (2); *V. dentata* var. *dentata* (2,13); *V. dentata* var. *lancifolia* (13).
 CRONARTIUM ARIZONICUM Cumm. 0,I on *Pinus ponderosa* (2,3,5,11) II,III on *Castilleja integra* (3); *C. laxa* (3,11); *C. linariaefolia* (3); *C. minor**; *C. patriotica* (2); *Castilleja* sp. (1,11).
 C. COMANDRAE Peck. 0,I on *Pinus eldarica* (14,3); *P. ponderosa* (3,10,14); II,III on *Comandra pallida* (2,3,14).
 C. CONIGENUM Hedg. & Hunt. 0,I on *Pinus leiophylla* var. *chihuahuana* (3,11); II,III on *Quercus arizonica* (2); *Q. dunni* (2); *Q. emoryi* (2,13); *Q. grisea* (2); *Q. hypoleucoides* (2,11); *Q. oblongifolia**; *Q. rugosa* (2).
 C. OCCIDENTALE Hedg. & Hunt. 0,I on *Pinus monophylla* (14); II,III on *Ribes aureum* (3,14); *R. nigrum* (10,14).
 CUMMINSIELLA MIRABILISSIMA (Peck) Nannf. 0,I,II,III on *Berberis repens* (3,4,5,11).
 C. WOOTONIANA (Arth.) Arth. II,III on *Berberis fremontii* (3,10,14); *B. haematocarpa* (15).
 ENDOCRONARTIUM HARKNESSII (J.P. Moore) Y. Hirat. III on *Pinus ponderosa* (2).
 ENDOPHYLLUM TUBERCULATUM (Ell. & Kell.) Arth. & Fromme. III on *Sidalcea neomexicana* (3).
 FROMMELLA DUCHESNEAE (Arth.) Yohem, Cumm., & Gilbn., comb. nov. (*Kuehneola duchesneae* Arth., N. Amer. Flora 7:185. 1912). II,III on *Duchesnea indica* (11).
 GYMNOSPORANGIUM BETHELII Kern. III on *Juniperus scopulorum* (3).
 G. CLAVIPES (Cke. & Peck) Cke. & Peck. 0,I on *Pyrus communis* (14).
 G. CUNNINGHAMIANUM Barcl. (*G. cupressi* Long. & Goodd.) 0,I on *Amelanchier alnifolia* (3); *A. utahensis* (6); III on *Cupressus arizonica* vars. (3,4,6,14).
 G. INCONSPICUUM Kern. 0,I on *Amelanchier utahensis* (3); III on *Juniperus deppeana* (2,3); *J. monosperma* (10); *J. osteosperma* (3).
 G. KERNIANUM Beth. 0,I on *Amelanchier utahensis**: *Pyrus communis* (14); III on *Juniperus deppeana* (2,3,4,5,11,12,13,14); *J. monosperma* (3,4,13); *J. osteosperma* (2,3,14).
 G. MULTIPORUM Kern. III on *Juniperus deppeana* (3); *J. monosperma* (3);

- J. osteosperma* (3).
- G. NELSONII Arth. 0,I on *Amelanchier utahensis* (1,3); *Crataegus oxyacantha* (14); *Cydonia oblonga* (14); *Pyrus communis* (10); III on *Juniperus deppeana* (3); *J. monosperma* (3); *J. osteosperma* (3,9).
- G. NIDUS-AVIS Thaxt. 0,I on *Amelanchier utahensis* (3); III on *Juniperus scopulorum* (1,3,10); *Juniperus* sp. (12).
- G. SPECIOSUM Peck. 0,I on *Fendlera rupicola* (2,13); *Philadelphus microphyllus* (13); III on *Juniperus deppeana* (2,11,13,14); *J. monosperma* (3,13,14); *J. osteosperma* (3).
- G. TREMELLOIDES Hartig. 0,I on *Sorbus dumosa* (3).
- G. VAUQUELINIAE Long & Goodd. 0,I on *Vauquelinia californica* (12); III on *Juniperus monosperma* (12).
- HYALOPSORA CHEILANTHIS Arth. II,III on *Cheilanthes pringlei**; *Notholaena sinuata* (2).
- H. POLYPODII (Diet.) Magn. II,III on *Cystopteris fragilis* (2).
- MELAMPSORA ALBERTENSIS Arth. 0,I on *Pseudotsuga menziesii* var. *glauca* (1); II,III on *Populus tremuloides* (1,2,3,11,14).
- M. EPITEA Theum. II,III on *Salix bonplandiana* (13); *S. bebbiana* (3); *S. exigua* (2); *S. gooddingii* (2,6,11,12,13); *S. scouleriana* (1,2,3,5,11); *S. taxifolia* (11); *Salix* sp. (14).
- M. HYPERICORUM Wint. II,III on *Hypericum formosum* (11).
- M. LINI (Ehrenb.) Lév. 0,I,II,III on *Linum lewisii* (3,11).
- M. MONTICOLA Mains. II,III on *Euphorbia brachycera* (2); *E. incisa* (2,11); *E. lurida* (2); *E. palmeri* (1,3,4,5,11); *E. robusta* (3,12).
- MELAMPSORELLA CARYOPHYLLACEARUM Schroet. 0,I on *Abies concolor* (3); *A. lasiocarpa* var. *arizonica* (3).
- NYSSOPSORA CLAVELLOSA (Berk.) Arth. III on *Aralia racemosa* (2).
- PERIDERMIMUM EPHEDRAE Cke. 0,I on *Ephedra nevadensis* (9,14,15); *E. viridis* (3,9).
- PERIDERMIMUM FILAMENTOSUM Peck. (see also *Cronartium arizonicum*) 0,I on *Pinus ponderosa* (2,3,5,11).
- PHAKOPSORA CROTONIS (Burr.) Arth. 0,I,II,III on *Croton texensis* (11,13,14).
- PHRAGMIDIUM MONTIVAGUM Arth. 0,I,II,III on *Rosa fendleri* (1,3,6,10,14); *R. neomexicana* (3); *R. woodsii* (3).
- P. OCCIDENTALE Arth. 0,I,II,III on *Rubus parviflorus**.
- P. PECKIANUM Arth. 0,I,II,III on *Rubus neomexicanus* (2,3,5,11).
- P. ROSAE-CALIFORNICAE Diet. 0,I,II,III on *Rosa arizonica* var. *granulifera* (3).
- P. RUBI-IDAEE (DC.) Karst. 0,I,II,III on *Rubus strigosus* var. *arizonicus* (2,3,11).
- PHRAGMOPYXIS ACUMINATA (Long) Syd. 0,III on *Coursetia microphylla* (11).
- P. DEGLUBENS (Berk. & Curt.) Diet. 0,I,II,III on *Cracca edwardsii* (2,13).
- P. NOELII J. Bxt. 0,I,II,III on *Coursetia microphylla* (11).
- PILEOLARIA BREVIPES Berk. & Rav. 0,I,II,III on *Rhus radicans* var. *rydbergii* (13).
- P. EFFUSA Peck. 0,III on *Rhus radicans* var. *rydbergii* (2).
- P. PATZCUARENSIS (Holw.) Arth. 0,I,II,III on *Rhus trilobata* (3).
- PUCCINIA ABRUPTA Diet. & Holw. var. *ABRUPTA*. II,III on *Viguiera annua* (2,13); *V. dentata* var. *dentata* (2,5,11,13,14); *V. dentata* var. *lanatifolia* (2,3,13,14); *V. multiflora* (11).
- P. ACROPTILI Syd. II,III on *Centaurea repens* (11).
- P. ANDROPOGONIS Schw. 0,I on *Oxalis amplifolia* (13); *Penstemon virgatus**; II,III on *Andropogon hirtiflorus* (13); *A. scoparius* (3).
- P. ANGULATA Diet. & Holw. I,II,III on *Sisyrinchium longipes* (5).

- P. ANISACANTHI Diet. & Holw. 0,I,II,III on *Anisacanthus thurberi* (2, 11,13); *Carlownrightia arizonica* (11).
- P. ANTIRRHINI Diet. & Holw. II,III on *Antirrhinum majus* (11).
- P. ARISTIDAE Tracy var. CHAETARIAE Cum. & Husain. 0,I on *Boerhaavia* sp. (13); II,III on *Aristida adscensionis* (13); *Hilaria jamesii**.
- P. ASPARAGI DC. 0,I,II,III on *Asparagus officinalis* (10,15).
- P. ATROFUSCA (Dudl. & Thomp.) Holw. II,III on *Carex douglasii* (3); *C. siccata* (3); *Carex* sp. (11,13).
- P. BACCHARIDIS Diet. & Holw. 0,I,II,III on *Baccharis emoryi**; *B. glutinosa* (2,11,12,13); *B. viminea* (8).
- P. BALSAMORHIZAE Peck. 0,I,II,III on *Wyethia arizonica* (3).
- P. BIPORULA J. Baxt. 0,I,II,III on *Salvia lemmonii* (2,13).
- P. BISTORTAE (Strauss) DC. II,III on *Polygonum bistortoides* (3).
- P. BLASDALEI Diet. & Holw. 0,I,II,III on *Allium macropetalum* (2,5,11, 14).
- P. BOUTELOUAE (Jenn.) Holw. II,III on *Bouteloua curtipendula**.
- P. BRACHYPODII Otth var. POAE-NEMORALIS (Otth) Cum. & Greene. II,III on *Poa pratensis* (3,10).
- P. CACABATA Arth. & Holw. 0,I on *Gossypium barbadense* (11); *G. hirsutum* (2,13); *G. thurberi* (11); II,III on *Bouteloua aristidoides* (2,5,11,13); *B. barbata* and vars. (2,11,12); *B. eriopoda* (2); *B. hirsuta* (2).
- P. CALANTICARIAE J. Parm. 0,I,II,III on *Viguiera cordifolia* (2,13); *V. dentata* var. *dentata* (2,13).
- P. CALCITRAPAE DC. var. CENTAUREAE (DC.) Cum. 0,I,II,III on *Carthamus tinctorius* (8,11,15); *Cirsium arizonicum* (3,11); *C. drummondii* (1); *C. nidulum* (3); *C. ochrocentrum* (3); *C. parryi* (5); *C. pulchellum* (3,6).
- P. CALIFORNICA Diet. & Holw. var. CALIFORNICA. II,III on *Cirsium arizonicum* (11); *C. wrightii* (8).
- P. CALIFORNICA Diet. & Holw. var. DESERTICOLA Savile. II,III on *Cirsium neomexicanum* (11).
- P. CALOCHORTI Peck. 0,I,II,III on *Calochortus ambiguus* (11); *C. kennedyi* (12,13); *C. nuttallii* (1,4).
- P. CANALICULATA (Schw.) Lagh. 0,I on *Ambrosia confertifolia* (11); *Bahia dissecta* (2); *Cosmos parviflora* (13); *Heliopsis parvifolia* (13); *Xanthium strumarium* (10); II,III on *Cyperus esculentus* (2,6,14); *C. fendlerianus* (13); *C. rusbyi* (2,13).
- P. CARICINA DC. II,III on *Carex senta* (3).
- P. CHLORIDIS Speng. 0,I on *Asclepias asperula* ssp. *capricornu* (4); *A. brachystephana**; *A. pumila**; *A. subverticillata* (14); *Sarcostemma cynanchoides* var. *hartwegii**; II,III on *Bouteloua gracilis**; *B. hirsuta* (13); *B. curtipendula* (13); *Chloris virgata* (13).
- P. CICUTAE Lasch. 0,I,II,III on *Cicuta maculata* (3).
- P. CNICI-OLERACEI Pers. ex Desm. III on *Artemisia ludoviciana* (2,11); *Aster commutatus* (3); *A. coerulescens* (3); *A. subulatus* var. *ligulatus* (3).
- P. COGNATA Syd. 0,I,II,III on *Verbesina encelioides**; *V. longifolia* (2).
- P. CONCINNA Arth. II,III on *Eupatorium greggii* (2).
- P. CONFRAGA Arth. & Cum. III on *Keckiella antirrhinoides* var. *microphylla* (4,8).
- P. CONOCLINII Seem. ex Burr. 0,I,II,III on *Eupatorium herbaceum* (13); *E. pycnocephalum* (2,11,13); *E. solidaginifolia**.
- P. CONVULVULI (Pers.) Cast. 0,I,II,III on *Convolvulus cneorum* (11).
- P. CORONATA Cda. II,III on *Holcus lanatus* (3); *Lolium perenne* (12).
- P. CRANDALLII Pam. & Hume. 0,I on *Symphoricarpos oreophilus* (2,3); II, III on *Koeleria nitida* (2); *Poa fendleriana* (2,3,11); *P. longiligula*

(3).

- P. CRYPTANDRI Ell. & Barth. var. CRYPTANDRI. II,III on *Sporobolus cryptandrus* (11); *S. giganteus* (2).
- P. CRYPTANDRI Ell. & Barth. var. LUXURIANS (Barth.) Cumm. & Greene. II,III on *Sporobolus airoides* (10); *S. wrightii* (11).
- P. CYNODONTIS Lacroix ex Desm. II,III on *Cynodon dactylon* (2,8,11,12, 15).
- P. DIETELII Sacc. & Syd. 0,I on *Acalypha neomexicana* (13); *A. ostryae-folia* (13); II,III on *Chloris virgata* (2,11,13).
- P. DIOICAE P. Magn. 0,I on *Artemisia carruthii* (3); *Camissonia hookeri* (2,3,11); *C. laciniata* (11); *Hieracium fendleri* (5); *Solidago missouriensis* (3); *S. sparsiflora* (3); II,III on *Carex praegracilis* (3); *C. siccata**; *C. vallicola* var. *rusbyi**; *Carex* sp. (2,3,11,14).
- P. DIPLACHNIS Arth. 0,I on *Bouvardia glaberrima* (2,11,12,13); II,III on *Leptochloa dubia* (2,12,13).
- P. DISTORTA Holw. III on *Hyptis emoryi* (8,12).
- P. DURANGENSIS Cumm. II,III on *Piptochaetium fimbriatum* (2); *Stipa pringlei* (2).
- P. DYSSODIAE Cumm. III on *Dyssodia pentachaeta* (2).
- P. ENCELIAE Diet. & Holw. 0,I,II,III on *Tithonia thurberi* (13); *Viguiera annua* (2,3,13,14); *V. longifolia* (13); *V. multiflora* (2,3,13, 14).
- P. ESCLAVENTIS Diet. & Holw. 0,I on *Mirabilis longifolia* var. *wrightiana* (2,11,13); *M. multiflora* (2); II,III on *Panicum bulbosum* (2,11, 13); *P. plenum* (13); *Setaria grisebachii* (2); *Tricachne californica* (2).
- P. EVADENS Hark. 0,I,II,III on *Baccharis emoryi* (11); *B. sarothroides* (2,8,11,12,13); *B. thesioides**.
- P. FARINACEA Long. II,III on *Salvia amissa* (8).
- P. FRANSERIAE Syd. 0,I,II,III on *Ambrosia deltoidea* (8,11,12,15); *A. dumosa* (8,15); *Hymenoclea salsola* var. *pentalepis* (8,11,14).
- P. GENTIANAE (Strauss) Roeh. 0,I,II,III on *Gentiana affinis* (1); *G. parryi* (1).
- P. GIBBERULOSA Schroet. III on *Ranunculus cardiophyllus* var. *subsagittatus**.
- P. GILIAE Hark. II,III on *Eriastrum diffusum* (8).
- P. GLOBOSIPES Peck. 0,I,II,III on *Lycium berlandieri* var. *parviflorum* (11); *L. californicum* (11); *L. exsertum* (4,11,12); *L. fremontii* (8,11,15); *L. parishii* (11); *L. torreyi* (14).
- P. GRAMINIS Pers. II,III on *Koeleria nitida* (11); *Lolium perrene* (8); *Phleum pratense* (1); *Triticum aestivum* (15).
- P. GRANULISPORA Ell. & Gall. 0,I,II,III on *Allium cernuum**; *A. plummerae* (2).
- P. GRINDELIAE Peck ssp. GRINDELIAE. III on *Chrysopsis foliosa* (8); *C. villosa* (3); *Ericameria laricifolia**; *Gutierrezia longifolia**; *G. sarothrae* (13,14); *G. serotina* (12,14); *Haplopappus junceus**; *Macheranthera gracilis* (13); *M. pinnatifida* (15).
- P. GRINDELIAE ssp. RIDDELLII (Griff.) Cumm. 0,I,II,III on *Baileya multiradiata* (11); *Psilostrophe cooperi* (11); *P. sparsiflora* (3); *P. tagetina**.
- P. GUILLEMINAE Diet. & Holw. I,II,III on *Brayulina densa* (2,11,12).
- P. HELIANTHI Schw. 0,I,II,III on *Helianthus annuus* (2,3,4,11,13); *H. petiolaris* (15); *Iva xanthifolia**.
- P. HETEROSPORA Berk. & Curt. III on *Abutilon californicum* (11); *A. incanum* (11,12); *A. parvulum* (12); *A. pringlei* (11); *A. sonorae* (11, 13); *A. thurberi* (11); *Herrisantia crispa* (11); *Sida filicaulis* (2, 12, 13); *S. physocalyx* (11); *S. spinosa* var. *angustifolia* (13).

- P. HEUCHERAE (Schw.) Diet. III on *Heuchera rubescens* (3); *H. sanguinea* var. *pulchra* (2).
- P. HIERACII (Roeh.) Mart. var. HIERACII. 0,I,II,III on *Agoseris glauca* (3); *Hieracium fendleri* (2); *Stephanomeria pauciflora* (3,11); *Taraxacum officinale* (3,10,13,14).
- P. HIERACII (Roeh.) Mart. var. HARKNESSII (Vize) Cum. 0,I,II,III on *Lygodesmia grandiflora**; *Rafinesquia neomexicana* (11); *Stephanomeria pauciflora* (3,11); *S. thurberi* (13).
- P. HYDROCOTYLES Cke. II,III on *Hydrocotyle verticillata* (11,14).
- P. INANIPES Diet. & Holw. I,II,III on *Eupatorium solidaginifolia* (2).
- P. INTERVENIENS Beth. II,III on *Stipa speciosa* (15).
- P. INVELATA H.S. Jacks. 0,I,II,III on *Parthenice mollis* (11).
- P. INVESTITA Schw. 0,I,III on *Gnaphalium macounii* (2,11,13).
- P. IRIDIS Rab. II,III on *Iris missouriensis* (2,3).
- P. JONESII Peck. 0,I,III on *Lomatium dissectum* (14); *L. nevadense* (9).
- P. KUHNIAE Schw. var. BRICKELLIAE (Peck) Cum. 0,I,II,III on *Brickellia coulteri* (2,11,12,13,14).
- P. KUHNIAE Schw. var. KUHNIAE. 0,I,II,III on *Brickellia amplexicaulis* (13); *B. betonicaefolia* (13); *B. chlorolepis* (2,13); *B. simplex* (2); *Kuhnia rosmarinifolia* (2,13).
- P. KUHNIAE Schw. var. ROBUSTA Cum. 0,I,II,III on *Brickellia lemmonii* (2).
- P. LEPTOCHLOAE Arth. & Fromme. 0,I on *Talinum paniculatum* (13); II,III on *Leptochloa filiformis* (13).
- P. LITHOSPERMI Ell. & Kell. 0,I,II,III on *Evolvulus alsinoides* var. *acapulcensis* (2,13).
- P. LOBATA Berk. & Curt. III on *Althaea rosea**; *Malvella lepidota* (2); *M. leprosa* (12,15).
- P. LUDOVICIANAЕ Fahr. 0,I,II,III on *Artemisia carruthii* (1); *A. ludoviciana* (3).
- P. MALVACEARUM Bert. ex Mont. III on *Althaea rosea* (2,3,10,12).
- P. MENTHAE Pers. 0,I,II,III on *Hedeoma dentatum* (11,13); *H. hyssopifolium* (13); *H. nanum* (14); *H. oblongifolium* (11); *Mentha arvensis**; *M. penardii* (3,11); *M. spicata* (3); *M. fistulosa* (4); *Monarda menthaefolia* (2,3,5,11,14).
- P. MINUSSENSIS Thuem. 0,I on *Lactuca pulchella* (10).
- P. MONOICA Arth. 0,I on *Arabis perennans* (1,11); *Arabis* sp. (3); *Sisymbrium linearifolium* (11); II,III on *Oryzopsis hymenoides* (3).
- P. MONTANENSIS Ell. II,III on *Agropyron smithii* (10); *Sitanion hystrix* (3,14);
- P. MUTABILIS Ell. & Gall. 0,I,II,III on *Allium acuminatum* (5).
- P. NEOCORONATA Greene & Cum. II,III on *Piptochaetium fimbriatum* (2,13); *Stipa pringlei* (2,11,13).
- P. NODOSA Ell. & Hark. 0,I,II,III on *Dichelostemma pulchellum* (3,8,11); *Triteleiopsis palmeri* (15).
- P. OBLIQUA Berk. & Curt. III on *Asclepias erosa* (11); *Calotropis procera* (11); *Cynanchum arizonicum* (13); *Matelea producta**; *Sarcolemma cynanchoides* (2,11,12,14); *S. hirtellum**.
- P. OENOTHERAE Vize. 0,I,II,III on *Camissonia brevipes* (15); *C. clavaeformis* (15); *Oenothera leptocarpa* (11).
- P. PALLIDISSIMA Speg. III on *Stachys coccinea* (8,11,13).
- P. PELARGONII-ZONALIS Doidge. II,III on *Pelargonium hortorum* (11).
- P. PENTSTEMONIS Peck. III on *Penstemon bridgesii* (3); *P. linarioides* (10); *P. pinifolius* (2); *P. pseudospectabilis* vars. (3,11,12).
- P. POARUM Niels. 0,I on *Brickellia californica* (2,11); *B. floribunda* (2); *B. grandiflora* (2); *B. rusbyi* (11); *Helenium hoopesii* (1,2,5,6,

- 9,11); II,III on *Agrostis scabra* (2,11); *Festuca arizonica* (2,11);
F. sororia (2,11); *Koeleria nitida* (2,11).
- P. POSADENSIS Sacc. & Trott. II,III on *Imperata brevifolia* (3).
- P. PSEUDOCYMOPTERI Holw. 0,I,II,III on *Pseudocymopterus montanus* (3).
- P. PULVERULENTA Grev. 0,I,II,III on *Gayophytum diffusum* (3); *G. racemosum* (5); *G. ramosissimum* (3).
- P. PUNCTATA Link. 0,I,II,III on *Galium mexicanum* ssp. *aspermum* (2,5, 11,13); *G. pilosum* (5); *G. triflorum* (5,11).
- P. PURPUREA Cke. II,III on *Sorghum halapense* (11,13); *S. vulgare* (11).
- P. PYGMAEA Eriks. 0,I on *Berberis repens* (3); II,III on *Koeleria nitida* (3,8).
- P. RECONDITA Rob. ex Desm. 0,I on *Clematis drummondii* (12); *C. ligusticifolia* (1,2,13); *Phacelia magellanica* (3); *Thalictrum fendleri* (2, 3,13,14); II,III on *Agropyron arizonicum* (2,11,13); *Agropyron trachycaulum* (3); *Bromus anomalus* (2,3); *B. ciliatus* (2,3); *B. frondosus* (2,3); *Elymus triticoides**; *Hordem vulgare* (2); *Secale cereale* (2); *Sitanion hystrix* (2,3,11,13); *Triticum aestivum* (15).
- P. RUFESCENS Diet. & Holw. I,III on *Pedicularis centranthera* (3,5,6, 14).
- P. SCHEDONNARDI Kell. & Swing. 0,I on *Sphaeralcea ambigua* var. *rosea**; *S. fendleri* (3); *S. grossulariaefolia* (2,11); *S. incana* (3); II,III on *Lycurus phleoides* (2,11,13); *Muhlenbergia asperifolia* (2); *M. emersleyi* (2,13); *M. montana* (3); *M. porteri* (3); *M. repens* (2); *M. rigens* (2); *M. utilis* (13).
- P. SHERARDIANA Koern. III on *Sphaeralcea ambigua* var. *rosea* (9,11,12, 14); *S. angustifolia* var. *cuspidata* (11); *S. emoryi* (3,11); *S. fendleri* (3); *S. laxa* (11,13); *S. marginata* (14); *S. parvifolia* (3,9); *Sphaeralcea* sp. (1,2,6).
- P. SIMILIS Ell. & Ever. II,III on *Artemisia nova* (3); *A. tridentata* (3).
- P. SONORICA Cumm. var. *SONORICA*. II,III on *Aristida hamulosa* (13); *A. ternipes* (11,13).
- P. SORGHI Schw. II,III on *Zea mays* (2,11).
- P. SPLENDENS Vize. 0,I,II,III on *Hymenoclea monogyra* (11,12,14); *H. salsola* var. *salsola* (11).
- P. STIPAE Arth. 0,I on *Chrysopsis villosa* (3); *Solidago altissima* (3); *S. nana* (3); II,III on *Oryzopsis hymenoides**; *Stipa comata* (3).
- P. STRIIFORMIS West. II,III on *Triticum aestivum**.
- P. SUBNITENS Diet. 0,I on *Atriplex rosea* (14); *Cammissonia chamaenerioides**; *Chenopodium album* (14); *C. chenopodioides* (14); *C. incanum* (14); *C. leptophyllum* (14); *C. morale* (14); *Cleome lutea**; *C. serrulata**; *Cryptantha barbigera**; *C. crassiseipala* (14); *C. pterocarpa**; *Datura meteloides* (14); *Draba cuneifolia* (14); *Eriogonum subreniforme* (14); *E. trichopes* (14); *Gilia sinuata**; *Lappula redowskii* (14); *L. texana* (14); *Lepidium lasiocarpum* (14); *Lesquerella gordonii* (14); *Linanthus bigelovii**; *Mirabilis multiflora* (14); *Nicotiana trigonophylla**; *Oxybaphus comatus**; *Pectocarya linearis* var. *ferocula**; *Petunia parviflora* (14); *Phacelia crenulata* (14); *Raphanus sativus**; *Rorripa nasturtium-aquaticum**; *Rumex hymenosepalus* (14); *Salsola iberica**; *Silene antirrhina**; *Spinacea oleracea* (14); *Verbena ciliata* (14); II,III on *Distichlis spicata* ssp. *stricta* (5,11,14).
- P. SUBSTERILIS Ell. & Ever. var. *ORYZOPSISIDIS* Greene & Cumm. II,III on *Oryzopsis hymenoides* (3).
- P. SUBSTRIATA Ell. & Barth. 0,I on *Physalis wrightii* (2); II,III on *Tricachne californica* (2).
- P. SUKSDORFII Ell. & Ever. III on *Agoseris glauca* (3).
- P. TANACETI DC. var. *DRACUNCULINA* (Fahr.) Cumm. 0,I,II,III on

- Artemisia dracunculus* (2,3,5,11); *A. ludoviciana* (3); *A. nova* (3); *A. tridentata* (3).
- P. TANACETI DC. var. TANACETI. II,III on *Chrysanthemum morifolium* (8).
- P. TETRAMERII Seym. 0,I,II,III on *Tetramerium hispidum* (11,13).
- P. THLASPEOS Schub. III on *Arabis* sp. (3); *Thlaspi montanum* var. *fendleri* (1).
- P. TUMIDIPES Peck. 0,I,II,III on *Lycium berlandieri* var. *parviflorum**; *L. pallidum* (2,3,9,10,11).
- P. TURGIDIPES H.S. Jacks. 0,I,II,III on *Viguiera deltoides* var. *parishii* (8,11,12).
- P. TUYUTENSIS Speg. I,II,III on *Cressa truxillensis* (8,15).
- P. UNICA Holw. var. UNICA. II,III on *Aristida arizonica* (13); *A. orcuttiana* (2); *A. ternipes* (11,13).
- P. VERSICOLOR Diet. & Holw. II,III on *Heteropogon contortus* (11).
- P. VERTISEPTA Tracy & Gall. II,III on *Salvia pinquifolia* (6).
- P. VEXANS Farl. 0,I on *Fouquieria splendens* (2,11); *Idria columnaris* (13); II,III on *Bouteloua curtipendula* (2,11,13).
- P. XANTHII Schw. III on *Ambrosia confertifolia* (14); *Xanthium strumarium* (1,2,10,11,14).
- P. XIMENESIAE Long. 0,I,II,III on *Verbesina rothrockii* (2).
- P. ZEXMENIAE Diet. & Holw. 0,I,II,III on *Zexmenia podoccephala* (2,13).
- PUCCINIASTRUM AGRIMONIAE (Diet.) Tranz. II,III on *Agrimonia gryposepala* (3).
- P. EPILOBII Otth. 0,I on *Abies concolor* (14); II,III on *Epilobium adenocaulon* (1,3,11); *E. californicum* (2); *E. halleanum* (3).
- P. GUTTATUM (Schroet.) Hylan., Joerst. & Nannf. II,III on *Galium triflorum* (5).
- P. PYROLAE Arth. II,III on *Pyrola picta* (3).
- RAVENELIA ARIZONICA Ell. & Ever. II,III on *Prosopis glandulosa* (2); *P. velutina* (2,11).
- R. EPIPHYLLA (Schw.) Diet. 0,I,II,III on *Tephrosia tenella* (13).
- R. FRAGRANS Long var. EVERNIA (Syd.) J. Baxt. II,III on *Mimosa biuncifera* (2,11,13); *M. dysocarpa* (2,13); *M. grahamii* (11,13); *M. laxiflora* (11).
- R. FRAGRANS Long var. FRAGRANS. II,III on *Mimosa biuncifera* (2,11,13); *M. dysocarpa* (2,13); *M. grahamii* (13).
- R. INDIGOFERAE Tranz. 0,I,II,III on *Indigofera sphaerocarpa* (13).
- R. MESILLANA Ell. & Barth. 0,I,II,III on *Cassia covesii* (11).
- R. PRINGLEI Cumm. 0,I,II,III on *Acacia greggii* var. *arizonica* (2,3,4,5,9,11,12,13,14).
- R. SPINULOSA Diet. & Holw. var. PAPILLIFERA (Syd.) Cumm. & J. Baxt. 0,I,II,III on *Cassia lindheimeriana* (2).
- R. TEXENSIS Diet. var. TEXENSIS. II,III on *Acacia angustissima* (2,11,13); *Calliandra eriophylla* (13); *C. humilis* (2,11,13,14); *C. humilis* var. *reticulata* (2,3,11,13); *Desmanthus cooleyi* (13).
- R. THORNBERRIANA Long. II,III on *Acacia constricta* var. *constricta* (2,4,11,13); *A. constricta* var. *paucispina* (11).
- TRANZSCHELIA COHAESA (Long) Arth. 0,I,III on *Anemone tuberosa* (11,12,13).
- T. PRUNI-SPINOSAE (Pers.) Diet. II,III on *Prunus serotina* ssp. *virens* (13); *P. virginiana* (12).
- T. THALICTRI (Chev.) Diet. III on *Thalictrum fendleri* (1,3).
- UREDINOPSIS PTERIDIS Diet. & Holw. II,III on *Pteridium aquilinum* var. *pubescens* (3,5,11).
- UREDO CUPRESSICOLA R.S. Pete. II on *Cupressus arizonica* (2).
- U. MEXICANA (Arth.) Cumm. II on *Rhus choriophylla* (2,13).

- U. PHORADENDRI H.S. Jacks. II on *Phoradendron juniperinum* (3).
 U. SPIROSTACHYDIS Arth. II on *Allenrolfea occidentalis* (15).
 UROMYCES AEMULUS Arth. 0,I,II,III on *Allium gooddingii* (11).
 U. APPENDICULATUS (Pers.) Unger. 0,I,II,III on *Phaseolus atropurpureus* (11); *P. vulgaris* (2).
 U. BELOPERONES G.F. Laund. 0,I,II,III on *Beloperone californica* (8,15).
 U. BETAЕ (Pers.) Tul. II on *Beta vulgaris* (8,15).
 U. COLORADENSIS Ell. & Ever. 0,I,II,III on *Vicia americana**.
 U. COMPACTUS Peck. 0,I,II,III on *Aster spinosus* (2).
 U. DACTYLIDIS Otth. II,III on *Alopecurus aequalis* (14); *A. geniculatus* (3).
 U. EPICAMPIS Diet. & Holw. II,III on *Muhlenbergia rigens* (2).
 U. ERAGROSTIDIS Tracy. 0,I on *Anthericum torreyi* (2,13); II,III on *Eragrostis intermedia* (2,11,13); *E. lehmanniana* (2).
 U. EUPHORBIAE Cke. & Peck. 0,I,II,III on *Euphorbia albomarginata* (3); *E. capitellata* (14); *E. chamaesula* (6); *E. dentata* var. *cuphusperma* (4,13); *E. fendleri* (10); *E. florida* (13); *E. glyptosperma* (3); *E. hirta* (13); *E. palmeri* (4,13); *E. plummerae* (13); *E. polycarpa* (11); *E. prostrata* (2,4,11); *E. serpyllifolia* (4).
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 U. GRAMINICOLA Burr. II,III on *Panicum* sp.*.
 U. HEDYSARI-PANICULATI (Schw.) Farl. II,III on *Desmodium* sp. (13).
 U. HYALINUS Peck. 0,I,III on *Sophora sericea* (2,3,10,11); *S. stenophylla* (10).
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 U. JUNCИ (Desm.) Tul. II,III on *Juncus xiphioides* (3).
 U. JUNCИ-EFFUSИ Syd. II,III on *Juncus ensiformis* (2); *J. xiphioides* (3).
 U. LIMONII (DC.) Lév. 0,I,II,III on *Limonium californicum* (4).
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 U. MEXICANUS Diet. & Holw. II,III on *Desmodium neomexicanum* (2,13); *D. procumbens* var. *exiguum* (2,13); *D. rosei* (11).
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 U. SILPHII (Burr.) Arth. II,III on *Juncus interior* (3).
 U. STRIATUS Schroet. II,III on *Medicago sativa* (2,5,10,11,15).
 U. SUKSDORFII Diet. & Holw. I,II,III on *Silene scouleri* (3).
 U. TRANZSCHELIИ Syd. III on *Euphorbia lurida* (12); *E. palmeri* (4); *E. robusta* (3).
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- U. VIGNAE Barcl. 0,I,II,III on *Vigna sinensis* (2).
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SEPTEMFIDA

Aecidium sp.

JUNCUS ENSIFOLIUM var. BRUNNESCENS

Uromyces junci-effusi

J. INTERIOR

Uromyces silphii

J. XIPHIODES

Uromyces junci

Uromyces junci-effusi

JUNIPERUS DEPPEANA

Gymnosporangium inconspicuum

Gymnosporangium kernianum

Gymnosporangium multiporum

Gymnosporangium nelsonii

Gymnosporangium speciosum

J. MONOSPERMA

Gymnosporangium inconspicuum

Gymnosporangium kernianum

Gymnosporangium multiporum

Gymnosporangium nelsonii

Gymnosporangium speciosum

Gymnosporangium vauqueliniae

J. OSTEOSPERMA

Gymnosporangium inconspicuum

Gymnosporangium kernianum

Gymnosporangium multiporum

Gymnosporangium nelsonii

Gymnosporangium speciosum

J. SCOPULORUM

Gymnosporangium bethelii

Gymnosporangium nidus-avis

KECKIELLA ANTIRRHINOIDES ssp.

MICROPHYLLA

Puccinia confraga

- KOELERIA NITIDA
 Puccinia crandallii
 Puccinia graminis
 Puccinia poarum
 Puccinia pygmaea
 LACTUCA PULCHELLA
 Puccinia minussensis
 LAPPULA REDOWSKII, L. TEXANA
 Puccinia subnitens
 LATHYRUS ARIZONICUS, L. EUCOSMOS,
 L. LEUCANTHUS var. LAETIVIRENS
 Uromyces viciae-fabae
 LEPIDIUM LASIOCARPUM var.
 LASIOCARPUM
 Puccinia subnitens
 LEPTOCHLOA DUBIA
 Puccinia diplachnis
 L. FILIFORMIS
 Puccinia leptochloae
 LESQUERELLA GORDONII
 Puccinia subnitens
 LIMONIUM CALIFORNICUM
 Uromyces limonii
 LINANTHUS BIGELOVII
 Puccinia subnitens
 LINUM LEWISII
 Melampsora lini
 LOLIUM PERRENE
 Puccinia coronata
 Puccinia graminis
 LOMATIUM DISSECTUM var. MULTIFIDUM
 Puccinia jonesii
 LUPINUS ARGENTEUS
 Uromyces occidentalis
 L. BLUMERI, L. PALMERI
 Uromyces lupini
 LYCIUM BERLANDIERI var.
 PARVIFLORUM
 Puccinia globosipes
 Puccinia tumidipes
 L. CALIFORNICUM, L. EXSERTUM,
 L. FREMONTII
 Puccinia globosipes
 L. PALLIDUM
 Aecidium lycii
 Puccinia tumidipes
 L. PARISHII
 Puccinia globosipes
 LYCURUS PHLEOIDES
 Puccinia schedonnardi
 LYGOESMIA GRANDIFLORA
 Puccinia hieracii var. harknessii
 MACHERANTHERA GRACILIS,
 M. PINNATIFIDA
 Puccinia grindeliae ssp.
 grindeliae
 MALVELLA LEPIDOTA, M. LEPROSA
 Puccinia lobata
 MATELEA PRODUCTA
 Puccinia obliqua
 MEDICAGO SATIVA
 Uromyces striatus
 MENTHA ARVENSIS var. VILLOSA,
 M. PENARDII, M. SPICATA
 Puccinia menthae
 MIMOSA BIUNCIFERA, M. DYSOCARPA,
 M. GRAHAMI, M. LAXIFLORA
 Ravenelia fragrans
 MIRABILIS MULTIFLORA
 Puccinia esclavensis
 Puccinia subnitens
 M. LONGIFLORA var. WRIGHTIANA
 Puccinia esclavensis
 MONARDA FISTULOSA, M. MENTHAEFOLIA
 Puccinia menthae
 MUHLENBERGIA ASPERIFOLIA,
 M. EMERSLEYI, M. MONTANA,
 M. PORTERI, M. REPENS
 Puccinia schedonnardi
 M. RIGENS
 Puccinia schedonnardi
 Uromyces epicampis
 M. UTILIS
 Puccinia schedonnardi
 NICOTIANA TRIGONOPHYLLA
 Puccinia subnitens
 NOTHOLAENA SINUATA
 Hyalopora cheilanthos
 OENOTHERA LEPTOCARPA,
 O. CALIFORNICA var. ARIZONICA
 Puccinia oenotherae
 ORYZOPSIS HYMENOIDES
 Puccinia monoica
 Puccinia stipae
 Puccinia substerilis var.
 oryzopsidis
 OXALIS AMPLIFOLIA
 Puccinia andropogonis
 OXYBAPHUS COMATUS
 Puccinia subnitens
 PANICUM sp.
 Uromyces graminicola
 P. BULBOSUM, P. PLENUM
 Puccinia esclavensis
 PARTHENICE MOLLIS
 Puccinia involata
 PECTOCARYA LINEARIS var. FEROCULA
 Puccinia subnitens
 PEDICULARIS CENTRANTHERA
 Puccinia rufescens
 PELARGONIUM HORTORUM
 Puccinia pelargonii-zonalis

- PENSTEMON BRIDGESII, P. LINARIOIDES
 P. PINIFOLIA, P. PSEUDOSPECTABILIS
 Puccinia pentstemonis
 P. VIRGATUS
 Puccinia andropogonis
 PETALOSTEMUM OCCIDENTALE
 Uropyxis petalostemonis
 PETUNIA PARVIFOLIA
 Puccinia subnitens
 PHACELIA CRENULATA
 Puccinia subnitens
 P. MAGELLANICA
 Puccinia recondita
 PHASEOLUS ATROPURPUREUS,
 P. VULGARIS
 Uromyces appendiculatus
 PHILADELPHUS MICROPHYLLUS
 Gymnosporangium speciosum
 PHLEUM PRATENSE
 Puccinia graminis
 PHORADENDRON JUNIPERINUM
 Uredo phoradendri
 PHYSALIS WRIGHTII
 Puccinia substriata
 PICEA ENGELMANNII, P. PUNGENS
 Chrysomyxa arctostaphyli
 PINUS EDULIS
 Coleosporium crowellii
 Coleosporium jonesii
 P. ELDARICA
 Cronartium comandrae
 P. LEIOPHYLLA var. CHIUAHUANA
 Coleosporium ipomoeae
 Cronartium conigenum
 P. MONOPHYLLA
 Cronartium occidentale
 P. PONDEROSA
 Cronartium arizonicum
 Cronartium comandrae
 Endocronartium harknessii
 PIPTOCHAETIUM FIMBRIATUM
 Puccinia durangensis
 Puccinia neocoronata
 POA FENDLERIANA, P. LONGILIGULA
 Puccinia crandallii
 P. PRATENSIS
 Puccinia brachypodii var.
 poae-nemoralis
 POLYGONUM BISTORTOIDES
 Puccinia bistortae
 POPULUS TREMULOIDES
 Melampsora albertensis
 PROSOPIS GLANDULOSA, P. VELUTINA
 Ravenelia arizonica
 PRUNUS SEROTINA ssp. VIRENS
 Tranzschelia pruni-spinosae
 PRUNUS VIRGINIANA
 Tranzschelia pruni-spinosae
 PSEUDOCYOPTERUS MONTANUS
 Puccinia pseudocymopteri
 PSEUDOTSUGA MENZIESII var. GLAUCA
 Melampsora albertensis
 PSILOSTROPHE COOPERI,
 P. SPARSIFLORA, P. TAGETINA
 Puccinia grindelii ssp. *riddellii*
 PSORALEA LANCEOLATA,
 P. TENUIFLORA var. BIGELOVII
 Uromyces psoraleae
 PTERIDIUM AQUILINUM var. PUBESCENS
 Uredinopsis pteridis
 PYROLA PICTA
 Pucciniastrum pyrolae
 P. VIRENS
 Chrysomyxa pirolata
 PYRUS COMMUNIS
 Gymnosporangium clavipes
 Gymnosporangium kernianum
 Gymnosporangium nelsonii
 QUERCUS ARIZONICA, Q. DUNNII,
 Q. EMORYI, Q. GRISEA,
 Q. HYPOLEUCOIDES, Q. OBLONGIFOLIA,
 Q. RUGOSA
 Cronartium conigenum
 RAFINESQUIA NEOMEXICANA
 Puccinia hieracii var. *harknessii*
 RANUNCULUS CARDIOPHYLLUS
 Puccinia gibberulosa
 RAPHANUS SATIVUS
 Puccinia subnitens
 RHUS CHORTIOPHYLLA
 Uredo mexicana
 R. RADICANS var. RYDBERGII
 Pileolaria brevipes
 Pileolaria effusa
 R. TRILOBATA
 Pileolaria patzcuarensis
 RIBES AUREUM
 Cronartium occidentale
 R. CEREUM, R. INEBRIANS,
 R. LEPTANTHUM
 Coleosporium jonesii
 R. NIGRUM
 Cronartium occidentale
 R. PINETORUM, R. VELUTINUM,
 R. WOLFFII
 Coleosporium jonesii
 RORIPPA NASTURTIUM-AQUATICUM
 Puccinia subnitens
 ROSA ARIZONICA var. GRANULIFERA
 Phragmidium californicum

- ROSA FENDLERI, R. NEOMEXICANA,
 R. WOODSII
 Phragmidium montivagum
 RUBUS LOGANOBACCUS
 Arthuriomyces peckianus
 R. NEOMEXICANUS
 Phragmidium peckianum
 R. PARVIFLORUS var. PARVIFLORUS
 Phragmidium occidentale
 R. STRIGOSUS var. ARIZONICUS
 Phragmidium rubi-idaei
 RUMEX HYMENOSEPALUS
 Puccinia subnitens
 SALIX BEBBIANA, S. BONPLANDIANA,
 S. EXIGUA, S. GOODDINGII
 S. SCOULERIANA, S. TAXIFOLIA
 Melampsora epitea
 SALSOLA IBERICA
 Puccinia subnitens
 SALVIA AMISSA
 Puccinia farinacea
 S. LEMMONII
 Puccinia biporula
 S. PINGUIFOLIA
 Puccinia vertisepta
 SARCOSTEMMA CYNANCHOIDES
 Puccinia obliqua
 S. CYNANCHOIDES var. HARTWEGII
 Puccinia chloridis
 Puccinia obliqua
 S. HIRTELLUM
 Puccinia obliqua
 SECALE CEREALE
 Puccinia recondita
 SETARIA GRISEBACHII
 Puccinia esclavensis
 SIDA PHYSOCALYX, S. FILICAULIS,
 S. SPINOSA var. ANGUSTIFOLIA
 Puccinia heterospora
 SIDALCEA NEOMEXICANA
 Endophyllum tuberculatum
 SILENE ANTIRRHINA
 Puccinia subnitens
 S. SCOULERI
 Uromyces suksdorfii
 SISYMBRIUM LINEARIFOLIUM
 Puccinia monoica
 SISYRINCHIUM LONGIPES
 Puccinia angulata
 SITANION HYSTRIX
 Puccinia montanensis
 Puccinia recondita
 SOLIDAGO ALTISSIMA
 Puccinia stipae
 S. MISSOURIENSIS
 Coleosporium asterum
 Puccinia dioicae
 SOLIDAGO NANA
 Puccinia stipae
 S. SPARSIFLORA
 Puccinia dioicae
 SOPHORA SERICEA, S. STENOPHYLLA
 Uromyces hyalinus
 SORBUS DUMOSA
 Gymnosporangium tremelloides
 SORGHUM HALAPENSE, S. VULGARE
 Puccinia purpurea
 SPHAERALCEA AMBIGUA var. ROSEA
 Puccinia schedonnardi
 Puccinia sherardiana
 S. ANGUSTIFOLIA var. CUSPIDATA,
 S. EMORYI
 Puccinia sherardiana
 S. FENDLERI
 Puccinia schedonnardi
 Puccinia sherardiana
 S. GROSSULARIAEFOLIA, S. INCANA
 Puccinia schedonnardi
 S. LAXA, S. MARGINATA,
 S. PARVIFOLIA
 Puccinia sherardiana
 SPINACEA OLERACEA
 Puccinia subnitens
 SPOROBOLUS AIROIDES, S. CRYPTANDRUS
 S. GIGANTEUS, S. WRIGHTII
 Puccinia cryptandri
 STACHYS COCCINEA
 Puccinia pallidissima
 STEPHANOMERIA PAUCIFLORA,
 S. THURBERI
 Puccinia hieracii
 STIPA COMATA
 Puccinia stipae
 S. LETTERMANNII
 Puccinia substerilis var.
 substerilis
 S. PRINGLEI
 Puccinia durangensis
 Puccinia neocoronata
 S. SPECIOSA
 Puccinia interveniens
 SUAEDA TORREYANA
 Uromyces giganteus
 SYMPHORICARPOS OREOPHILUS
 Puccinia crandallii
 TALINUM PANICULATUM
 Puccinia leptochloae
 TARAXACUM OFFICINALE
 Puccinia hieracii var. *hieracii*
 TEPHROSIA TENELLA
 Ravenelia epiphylla
 TETRAMERIUM HISPIDUM
 Puccinia tetramerii

- THALICTRUM FENDLERI
 Puccinia recondita
 Tranzschelia thalictri
 THLASPI MONTANUM var. FENDLERI
 Puccinia thlaspeos
 TITHONIA THURBERI
 Puccinia enceliae
 TRICACHNE CALIFORNICA
 Puccinia esclavensis
 Puccinia substriata
 TRIFOLIUM SUBCAULESCENS
 Uromyces minor
 TRITELEIOPSIS PALMERI
 Puccinia nodosa
 TRITICUM AESTIVUM
 Puccinia graminis
 Puccinia recondita
 Puccinia striiformis
 VAUQUELINIA CALIFORNICA
 Gymnosporangium vauqueliniae
 VERBENA CILIATA
 Puccinia subnitens
 VERBESINA ENCELIODES
 Coleosporium viguierae
 Puccinia cognata
 V. LONGIFOLIA
 Puccinia cognata
 V. ROTHROCKII
 Puccinia ximenesiae
 VICIA AMERICANA var. AMERICANA
 Uromyces coloradensis
 Uromyces viciae-fabae
 VICIA AMERICANA var. LINEARIS,
 V. PULCHELLA
 Uromyces viciae-fabae
 VIGNA SINENSIS
 Uromyces vignae
 VIGUIERA ANNUA
 Puccinia abrupta
 Puccinia enceliae
 V. CORDIFOLIA
 Coleosporium viguierae
 Puccinia calanticariae
 V. DELTOIDEA var. PARISHII
 Puccinia turgidipes
 V. DENTATA var. DENTATA
 Coleosporium viguierae
 Puccinia abrupta var. *abrupta*
 Puccinia calanticariae
 V. DENTATA var. LANCIFOLIA
 Coleosporium viguierae
 Puccinia abrupta var. *abrupta*
 V. LONGIFOLIA, V. MULTIFLORA
 Puccinia abrupta var. *abrupta*
 Puccinia enceliae
 WYETHIA ARIZONICA
 Puccinia balsamorhizae
 XANTHIUM STRUMARIUM
 Puccinia canaliculata
 ZEA MAYS
 Puccinia sorghi
 ZEXMENIA PODOCEPHALA
 Puccinia zexmeniae

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ADDITIONS TO *MARASMIUS* SECTION *GLOBULARES*

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Marasmius albogriseus is re-described based on recent collections from southern California, and *Collybia fimicola* is verified as its later synonym. *Marasmius decipiens* is described as a new species in section *Globulares*. The colored, extremely long, narrow, and slightly curved spores serve to distinguish it from others in the section.

Since the synopsis of *Marasmius* section *Globulares* for the United States (Halling, 1983b), additional information on members of this section has come to our attention. First of all, fresh material of *Marasmius albogriseus* (Pk.) Sing. has been collected recently in southern California near the type locality. The collections differ slightly from the type specimen in that the caulocystidia are more polymorphous and are not thick-walled. Furthermore, these recent collections were found to be indistinguishable from the type and other original collections of *Collybia fimicola* Earle, thus substantiating the synonymy given by Singer (1976). Earlier, Halling (1983b) refrained from accepting this synonymy because additional Californian specimens were not available. Because these recent collections of *M. albogriseus* from southern California represent the only

known ones from the area since the species was originally described, we provide the following updated description. Color terms (e.g. 5C4) are from Kornerup and Wanscher (1967).

MARASMIUS ALBOGRISEUS (Pk.) Sing., Ann. Mycol.

41: 130. 1943.

Figs. 1,9,10.

Collybia albogrisea Pk., Bull. Torrey Bot. Club 22: 199. 1895. *Gymnopus albogriseus* (Pk.) Murr., N. Amer. Fl. 9: 368. 1916. TYPE: United States. California: Los Angeles Co., Pasadena. 10 Jan 1895, A. J. McClatchie 814 (Holotype: NYS!; Isotype: NY!).

Collybia fimicola Earle, Bull. New York Bot. Gard. 3: 298. 1905. TYPE: United States. California: Santa Clara Co., near Stanford University. 30 Nov 1901, C. F. Baker's *Pacific Slope Fungi* no. 153 (Holotype: NY!; Isotype: FH!).

Pileus 15-35 mm broad, broadly conic to convex to broadly convex to plane, subumbonate or uneven in outline from mutual pressure; margin even and translucent-striate when young, becoming plicate-striate to sulcate, irregular or scalloped with age, remaining smooth on the disc; surface glabrous, moist to lubricous when wet but not viscid, hygrophanous, grayish brown (5C4; 5D4) on the disc, paler at the margin, tending toward a pale grayish yellow (4B4; 4B3) overall with age. *Context* pliant, up to 5 mm thick, grayish white. *Odor* mild; *taste* mild or none. *Lamellae* narrowly adnexed to broadly adnexed or nearly free, moderately distant to subdistant, very broad (up to 6 mm), ventricose, thick, minutely intervenose in larger, mature individuals, white to yellowish white (3A2; 4A2) when young, becoming grayish yellow (near 4B3; 4B2) when old or wet; edges even and entire. *Lamellulae* in 1-2 series. *Stipe* 20-50(-70) mm long, 2-6 mm broad, terete to compressed, seldom cleft, equal or tapered downward, rarely slightly enlarged at the base, tough-fibrous, non-insititious, strict or sometimes curved at base, hollow, translucent above, shiny; apex glabrous or minutely pruinose (under a lens), glabrescent, whitish to grayish pallid when young, remaining so in age; base pubescent to tomentose or strigose, the tomentum often well-developed, amber yellow (4B6) at first, becoming brownish orange (6C7) with age, concolorous within.

Basidiospores white in deposit, 6.6-8.1(-9) X 3.6-4.5 (-5.4) μ m, broadly ellipsoid, amygdaliform to lacrymoid, inequilateral and adaxially flattened in profile, smooth,



Figs. 1,2. Habit photographs of (1) *Marasmius albo-griseus* (Halling 3773). (2) *Marasmius decipiens* (Holotype). Both approx. X1.5.

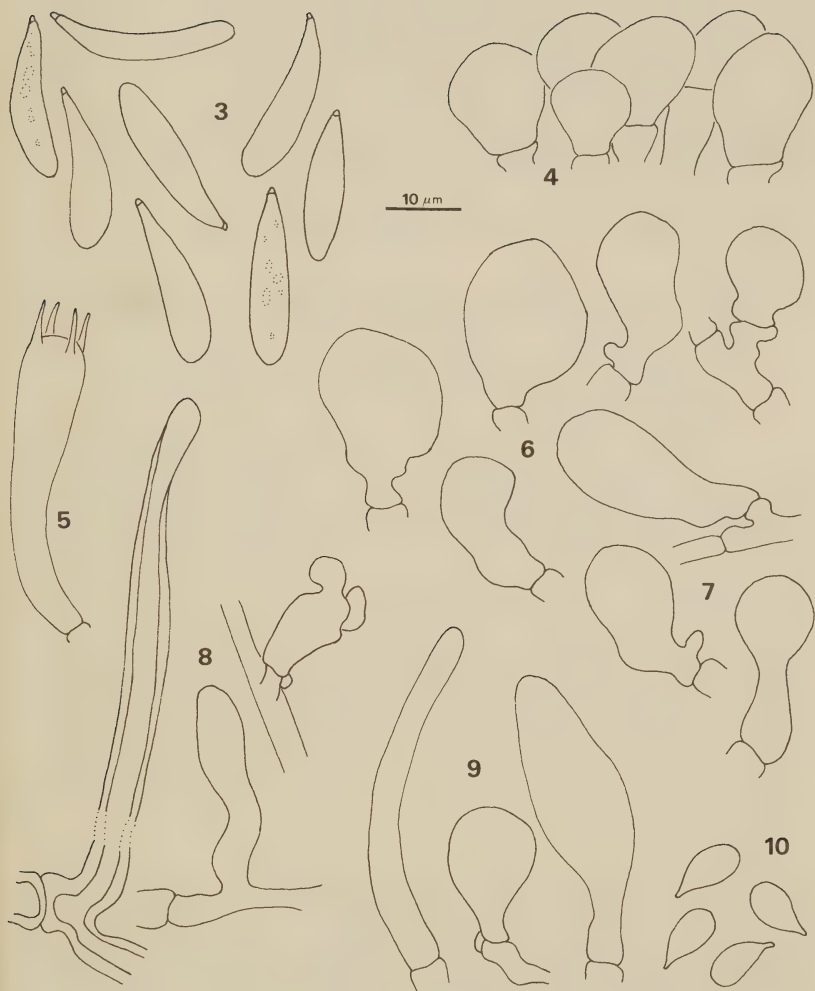
thin-walled, hyaline, inamyloid, typically uniguttulate. *Basidia* 18-26.6(-36) X 6-7.2(-8) μm , clavate, hyaline 1-, 2-, or 4-sterigmate. *Hymenial cystidia* absent. *Trametal hyphae* interwoven, dextrinoid, sometimes inflated, usually hyaline or pale yellowish in KOH, occasionally with oleiferous elements in the stipe and pileus, 3-18 μm in diam; walls up to 1.2 μm thick. *Clamp connections* present. *Pileus surface* composed of smooth endcells, embedded in a thin, gelatinous matrix, forming a hymeniform layer up to 25 μm thick; elements 12-25 X 3.6-9(-13) μm , cylindric, clavate to subacuminate, broadly clavate or sphaeropedunculate; walls thin, hyaline or pale yellow to ochraceous, inamyloid or weakly dextrinoid. *Caulocystidia* abundant, sometimes scattered in clusters, repent to erect, weakly dextrinoid, thin-walled, very rarely thick-walled, hyaline to pale yellowish, 11-33 X (3.6-)6-9 μm , typically broadly clavate, elongate-clavate, strangulate, fusoid-ventricose to sphaeropedunculate, or narrowly cylindric and irregular in outline (this latter especially at the base of stipe).

Gregarious to cespitose on soil, often among wood chips in disturbed soil, near *Quercus* sp., *Purshia* sp., *Pinus* sp., *Cupressus forbesii* Jeps., and *Olea* sp. Locally abundant in southern California from December through March.

Additional material examined: United States. California: Los Angeles Co., La Cañada. Descanso Gardens, 28 Dec 1983, *Halling* 3773; 20 Dec 1984, *Halling* 3998 (NY, SFSU). Claremont, Rancho Santa Ana Botanical Garden, 30 Dec 1977, *G. Wright* 815 (SFSU). Santa Clara Co., Stanford University, 19 Jan 1907, *Patterson* #6, 31 Jan 1907, *Patterson* #16 (both NY). San Diego Co., Lake Henshaw, San Luis Rey Campground, 10 Mar 1970, *Thiers* 25080 (SFSU).

Marasmius albogriseus is keyed out together with *M. oreades* (Bolt.:Fr.) Fr. because both lack hymenial cystidia (*Halling*, 1983b). However, *M. albogriseus* differs from *M. oreades* in having a pale grayish brown rather than a light yellowish brown pileus. Furthermore, the spores of *M. oreades* are longer (7-10 versus 5-7 μm), and the stipe tomentum is sparser than that of *M. albogriseus*. The caulocystidia of *M. albogriseus* are also quite polymorphous when compared to the nearly uniform, cylindric to clavate elements found in *M. oreades*.

Another taxon, collected over the past several years in North Carolina, appears to be undescribed. The plicate pileus and remote lamellae might lead one to look for this species in section *Sicci* with *M. pulcherripes* Pk. and *M. siccus* (Schw.) Fr., but broom cells are entirely lacking.



Figs. 3-10. Microscopic features of *Marasmius albo-griseus* and *M. decipiens*. 3-8. *M. decipiens*. 3. Basidiospores. 4. Elements of pileus surface. 5. Basidium. 6,7. Cheilocystidia. 8. Caulocystidia. 9-10. *M. albo-griseus*. 9. Caulocystidia. 10. Basidiospores.

There is a superficial resemblance to *M. wynnei* Berk. & Br. (Dähncke & Dähncke, 1982), a European member of section *Globulares*, but the latter species does not produce elongate curved spores over 20 μm long that are colored in deposit. Although colored spore deposits are becoming more widely reported for other taxa of Tricholomataceae (Bigelow, 1982; Gilliam, 1976; Halling, 1983a; Lennox, 1979), the application of this feature does not seem to be used at the same taxonomic level in all cases. This addition to section *Globulares* is described below. The color notations in parentheses are from Kelley and Judd (1955).

MARASMIUS DECIPIENS Halling, Desjardin, & Tish *sp. nov.*

Figs. 2-8.

A speciebus aliis sectionis Globularibus basidiosporis coloratis longissimis elongato-clavatis subfusiformibus aliquando de visu laterali curvatis et cheilocystidiis brevibus sacciformibus distinguenda.

Pileus up to 25 mm broad, parabolic to campanulate or obtusely convex at first, becoming more convex to plane with maturity; surface dry. canescent, light grayish yellowish brown (79. 1. gy. y Br) on the margin and toward the disc, but darker on the disc, conspicuously sulcate from the beginning, somewhat darker in the sulci. *Flesh* thin. *Odor* slightly acrid; *taste* none. *Lamellae* adnate, distant to remote, ventricose, with slight intervenations when dry, a very pale grayish, but lighter than cap. *Stipe* up to 70 mm long, 1-2 mm thick at apex, broader toward the base; surface glabrous above, strigose to pubescent below mid-stipe, especially at the base, pallid to concolorous with lamellae above, brownish below, particularly with age and desiccation, pubescence whitish; interior hollow; not insititious.

Basidiospores reddish gray (22. r Gray) in deposit, 22.5-25.2 X 4.5-6.3 μm , lanceolate-subfusiform to elongate-clavate, sometimes curved in profile, frequently multi-guttulate, smooth, thin-walled, inamyloid, sterigmal appendage highly refractive. *Basidia* 31-45 X 7-9 μm , clavate to sub-clavate, 4-sterigmate. *Pleurocystidia* absent. *Cheilocystidia* very short, saccate and subglobose to broadly clavate or sphaeropedunculate, rarely with diverticulate excrescence, otherwise smooth, thin-walled, (6.3-)7.2-11.7(-22.5) μm , soon collapsing on lamellar edge and very inconspicuous. *Trametal hyphae* interwoven, dextrinoid, smooth, thin-walled, 3.6-10 μm in diam. *Clamp connections* present. *Pileus*

surface composed of thin-walled, smooth, pyriform, turbinate to sphaeropedunculate elements, (4.5-)9-12.6(-18) μm broad, forming a hymeniform layer. *Caulocystidia* short and scattered at apex to mid-stipe, these usually thin-walled, cylindric, globose, clavate or irregularly cylindric; long and densely packed toward the base, these filamentous-cylindric near their tips and knotty-contorted near the stipe surface, with walls up to 2 μm thick; all caulocystidia 2.7-5.4 μm in diam and arising as recurved tips or as intercalary branches from golden-brown, slightly thick-walled surface hyphae.

Solitary, gregarious to cespitose in decaying leaves (mostly *Quercus* and *Rhododendron*). Western North Carolina. June.

TYPE: United States. North Carolina, Transylvania Co.: Cedar Mountain, near Brevard, Sherwood Forest, 19 Jun 1980, Tish 1602-F (Holotype: NY). Paratype: as above, 2 Jun 1982, Tish 9503; 25 Jun 1984, Tish s.n. (both NY).

The combination of dextrinoid tramal hyphae and a pileus surface of smooth endcells arranged in hymeniform fashion clearly indicate section *Globulares* for this species. The reddish gray spore deposit and the elongate, curved spores exceeding 20 μm in length are the unique features of *M. decipiens* distinguishing it from others in the section.

ACKNOWLEDGMENTS

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NEW COMBINATIONS IN THE PLEOMASSARIACEAE AND THE MASSARINACEAE

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SUMMARY

Six new combinations are made for species once named in *Trematosphaeria* but referable to the Pleomassariaceae or the Massarinaceae:

Asteromassaria berberidicola, *A. daphnes*,
Splanchnonema britzelmayriana, *Massarina piskorzii*, *M. indigoferae*, and *M. mori*.

During the course of studies on species named in *Trematosphaeria* (Boise, 1984) I discovered six species that unlike *T. pertusa* (Pers.: Fr.) Fuckel, the generic type, possessed the characteristics of the Pleosporales and furthermore the characteristics of either the Pleomassariaceae or Massarinaceae. New combinations are made for these species in the genera *Asteromassaria*, *Splanchnonema*, and *Massarina*.

All of the species described here exhibit the cellular type of pseudoparaphyses and bipolar ascospore symmetry that are indicative of species in the Pleosporales, as it is delimited by Barr (1979, 1983). To recognize species in the Pleomassariaceae, I followed the general criteria outlined in Barr's treatment of North American species (1982) and for the Massarinaceae I used Barr's keys for families in the Loculoascomycetes (1979) along with the studies of Bose (1961) and Holm (1957). In addition, I consulted Eriksson's work (1981) and found the descriptions of asci of particular help in separating the families.

Like other species in the Pleomassariaceae, *Asteromassaria berberidicola*, *A. daphnes* and *Splanchnonema*

britzelmayriana produce sphaeroid, broadly papillate ascomata that are immersed, later erumpent, from woody substrates. Their asci are cylindric-clavate and most noticeably have endotunicae that are at least twice as thick as the ectotunicae. *Asteromassaria* and *Splanchnonema* are phragmosporous members of the family that can be separated by the shape of the ascospores, which are ellipsoid-fusoid or oblong in *Asteromassaria* and obovoid in *Splanchnonema*; also, the ascospore wall tends to be thicker in species of *Asteromassaria*.

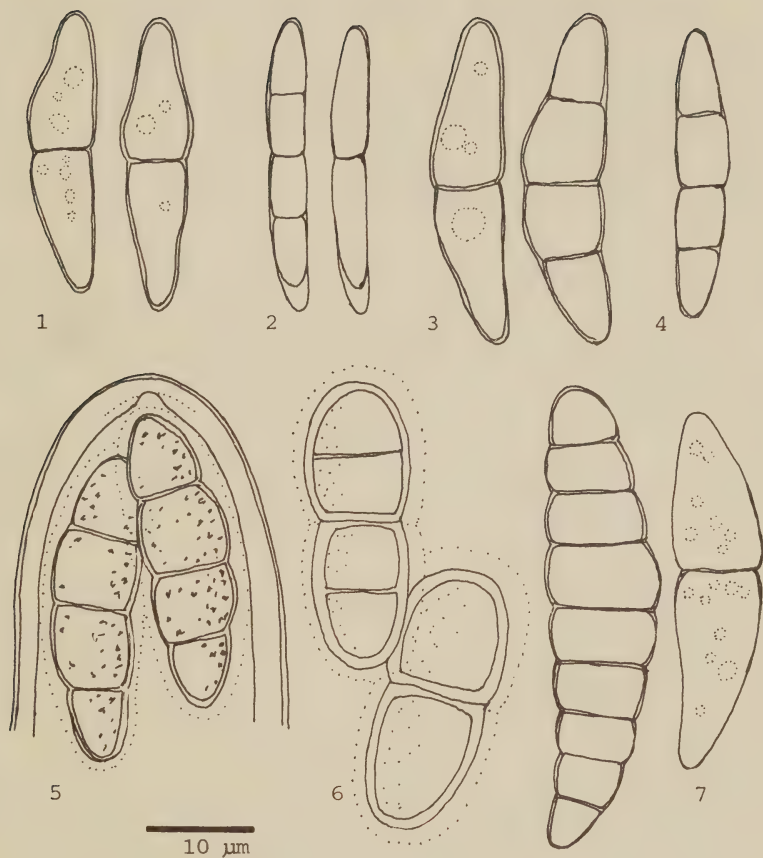
Asteromassaria berberidicola and *A. daphnes* can be separated by the shape of their ascospores, and perhaps geographic distribution. Ascospore dimensions in both species fall within the lower extreme described for *A. macrospora* (Desm.) v. Höhnelt (Barr, 1982), however, ascomata in *A. macrospora* are larger and the ascospores are smooth or foveolate. *Asteromassaria olivaceohirta* (Schw.) Barr is regarded as a synonym of yet another species named in *Trematosphaeria*, viz., *T. epileuca* (Berk. & Curt.) Shoemaker & LeClair (Barr, 1982; Boise, 1984). *Splanchnonema britzelmayriana* is comparable with *S. sporadicum* (Ellis & Everh.) Barr. However, in *S. sporadicum* the ascospores are smaller and verruculose.

Asteromassaria berberidicola (Otth) Boise, comb. nov.

Fig. 5. Basionym: *Cladosphaeria berberidicola* Otth, Mittheil. Naturf. Ges. Bern 1870: 105. 1871. *Massaria berberidicola* (Otth) Jacz., Bull. Herb. Boissier 2: 673. 1894. *Trematosphaeria berberidicola* (Otth) Shoemaker & LeClair, Canad. J. Bot. 53: 1975. Type: (n.v.).

Ascomata sphaeroid, ca. 0.5 mm diam, papillate, immersed to erumpent. Pseudoparaphyses cellular, 1.5–2 μ m wide. Asci cylindric-clavate, up to 110 X 28 μ m, endotunicae thick. Ascospores ellipsoid-fusoid, 1–3-septate, thick-walled, brown with end cells lighter brown or hyaline becoming verruculose, (26–)28–35(–38) X 9–14 μ m within a gelatinous sheath.

Material examined: Rehm, Ascom. 1866, on *Berberis* (NY) Canada, Manitoba, Winnipeg, Manitoba Agricultural College, on *Salix*, 6-XII-1925, G. R. Bisby 2596 ex herb. Dearness 553 (as *Trematosphaeria pertusa*, DAOM 182892).



Figs. 1-7. Members of the Massarinaceae and Pleomassariaceae. 1. Ascospores of *Massarina corticola*. 2. Ascospores of *M. piskorzii*. 3. Ascospores of *M. indigoferae*. 4. Ascospore of *M. mori*. 5. Ascus apex and ascospores of *Asteromassaria berberidicola*. 6. Ascospores of *A. daphnes*. 7. Ascospores of *Splanchnonema britzelmayriana*.

Asteromassaria daphnes (Petrak) Boise, comb. nov.

Fig. 6. Basionym: *Trematosphaeria daphnes* Petrak, Sydowia 7: 65. 1953. Isotype: Iran, Ilam, Route de Gharb, on *Daphne angustifolia*, 4-VI-1951, Scharif (BPI!).

Ascomata immersed to erumpent, sphaeroid, 0.35-0.75 mm diam, papillate; peridium thin (10 μ m) at base, to 30 μ m at sides. Pseudoparaphyses cellular, 2 μ m wide. Asci cylindric-clavate, up to 230 X 19 μ m. Ascospores oblong 1-3-septate, thick-walled, brown, becoming verruculose, 23-32 X 9-12(-18) μ m, within a gelatinous sheath.

Splanchnonema britzelmayriana (Rehm) Boise, comb. nov.

Fig. 7. Basionym: *Melanomma megalosporum* var. *britzelmayriana* Rehm, Hedwigia 20: 51. 1881. *Trematosphaeria britzelmayriana* (Rehm) Sacc., Syll. Fungorum 2: 120. 1883. Isotype: Rehm, Ascom. 588 (NY!).

Ascomata immersed to erumpent, 0.4 mm diam, sphaeroid with short papillae. Pseudoparaphyses cellular, 2-3 μ m wide. Asci cylindric-clavate, up to 160 X 30 μ m. Ascospores obovoid, up to 7-8-septate, brown, minutely punctate, (27-)36-56 X 10-14 μ m.

In members of the Massarinaceae, the ascomata are $\pm$ sphaeroid with peridia of small-celled pseudoparenchyma or flattened cells (Barr, 1979) and asci with thin endo- and ectotunicae (Eriksson, 1981). The species described below also possess the characteristics of *Massarina*, including hyaline ascospores, and, any clypeal tissue or superficial hyphae are weakly developed.

Within *Massarina*, *M. piskorzii* is comparable to *M. microspora* (Fuckel) Sacc. and *M. canadensis* (Ellis & Everh.) Barr, in herb., yet *M. piskorzii* is distinguished by its host substrate and ascospore shape and appendages. The ascospores of *M. indigoferae* fall within the extremes described for *M. corticola*, but the average values are larger. The ascomata of the two species differ in that those in *M. corticola* have well developed papillae, and in *M. indigoferae* the papillae are not apparent, if not absent. The distinctive type locality and substrate for *M. indigoferae* give me further reservation about treating the name in synonymy with *M. corticola*. Likewise, I retain *M. mori* as a separate species although it too has ascospores that fall within the extreme size range described for *M. corticola*. *Massarina mori* can be separated from *M. corticola*

by the difference in ascospore shapes.

Massarina corticola(Fuckel) L. Holm, Symb. Bot. Upsal.
14: 147. 1957.

Fig. 1. *Trematosphaeria corticola* Fuckel, Symb. Mycol. 162. 1870. *Zignoella corticola*(Fuckel) Sacc., *Michelia* 1: 346. 1878. *Melomastia corticola*(Fuckel) Schröter, In: F. Cohn, Kryptogamenfl. Schlesien 2: 321. 1894. Isotype: Fuckel, Fungi rhenani 2528 (FH!).

Ascomata, at first immersed within periderm of old stems or beneath periderm of young twigs, becoming superficial, globose to sphaeroid, 0.2-0.5 mm diam, papillae protruding through to surface of substrate. Pseudoparaphyses cellular, 1-3 μ m wide. Asci cylindric-clavate, up to 125 X 17 μ m, ecto- and endotunicae thin. Ascospores fusoid, 1-(3-)septate, hyaline, (22-)25-32(-37) X 4-8 μ m.

Additional material examined: Sine loc., Herb. Fuckel, Herb. Barbey-Boissier 622 (FH); Herb. Persoon 910-269-164 (as *S. pertusa*, L); Switzerland, Fribourg, on *Fraxinus*, 21-VIII-1976, M. E. Barr (MASS); Canada, Quebec, Gaspé Prov. Park, Mt. Albert, on *Ledum*, 22-VIII-1957, M. E. Barr 2262 (MASS); USA, Massachusetts, Conway, Baptist Hill, on *Tilia*, 20-V-1967, M. E. Barr 933 (MASS); Michigan, Emmet Co., Gill+Elder Roads, on *Sambucus*, 11-IX-1969, M. E. Barr 5524d (MASS); New York, 1 mi. west of Saranac Lake, on tree stump, 11-IX-1965, D. Malloch, 494 (DAOM 136383).

Massarina piskorzii(Petrak) Boise, comb. nov.

Fig. 2. Basionym: *Trematosphaeria piskorzii* Petrak, Ann. Mycol. 25: 366. 1927. Isotypes: Petrak Flora Bohemiae et Moraviae exsiccata 2298, on *Phragmites communis*, V-1926, J. Piskorz (BPI!, FH!, NY!).

Discoloring the surface of the host substrate in grey patches (0.5-1.0 mm diam), dotted by the protruding papillae of ascomata clustered beneath the epidermis within a loose web of hyphae. Ascomata globose, 0.25-0.5 mm diam, peridium thin (15 μ m). Pseudoparaphyses cellular, 1.5-2.5 μ m wide. Asci cylindric-clavate, up to 120 X 12 μ m. Ascospores narrow oblong, 1-3-septate, with short basal appendages, hyaline to clear gold, 20-32 X 4-6 μ m.

Massarina indigoferae(Müller & Ahmad) Boise, comb. nov.

Fig. 3. Basionym: *Trematosphaeria indigoferae* Müller & Ahmad, Biologia(Lahore) 4: 25-32. 1958. Holotype:

Pakistan, Kagan Valley, Shogran, on dead branches of *Indigofera geradina* Wall, 28-VII-1956, S. Ahmad 14078 (ZT!).

Ascomata immersed beneath periderm, becoming superficial, globose to sphaeroid, 0.35-0.5 mm diam. Pseudoparaphyses cellular 1.5-2.0 μ m wide. Asci cylindric-clavate, up to 130 X 18 μ m, ecto- and endotunicae thin. Ascospores fusoid, 1-3-septate, hyaline, (33-)35-39(-42) X 7-9 μ m.

Massarina mori (Fabre) Boise, comb. nov.

Fig. 4. Basionym: *Trematosphaeria mori* Fabre, Ann. Sci. Nat. Bot. Sér. 6. 15: 53. 1883. Holotype: France, Vaucluse, Sérignan, on decorticated wood of *Morus alba*, I-1882, J.H.Fabre (L'Harmas!).

Ascomata immersed to erumpent, subglobose, 0.5 mm diam with minute papillae. Pseudoparaphyses cellular, 2 μ m wide. Asci cylindric-clavate, up to 120 X 12 μ m. Ascospores ellipsoid-fusoid, 1-3-septate, hyaline, becoming golden, 25-33 X 4-5 μ m.

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SOME NEW SPECIES AND NEW RECORDS OF DISCOMYCETES IN CHINA

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SUMMARY

Seven new species of Discomycetes are recorded from China: *Arachnopeziza subnuda*, *Coccomyces mucronatus* (also reported here from Indonesia), *Coccomyces sichuanensis*, *Gyromitra sichuanensis*, *Lambertella rubi*, *Psilachnum microallantosporum*, and *Trichophaea geoporoides*. Attention is drawn to eight probable new species in *Calycellina*, *Coprotus*, *Geopora*, *Hymenoscyphus*, *Moellerodiscus*, *Pachyella*, and *Plectania* (in sect. *Plectania* and in sect. *Sphaerosporeae*). Forty-two species and infraspecific taxa previously described are reported for the first time from China, including *Lachnum flavidulum*, *L. tenuissimum*, and *Hymenoscyphus scutula* var. *solani*, all new combinations. *Otidea purpurea*, *Lachnum javanicum*, and *Lanzia serotina* are proposed as new combinations for the previously reported *Acetabula purpurea*, *Erinella javanica*, and *Helotium serotinum*. Two species previously reported from China, *Mollisia viridulo-mellea* and *Erinella sinensis*, are reported here as later synonyms of *Chlorosplenium chlora* and *Lachnum abnormis*, respectively. The reports of *Orbilbia sinuosa* from China are based on a specimen of *Bisporella discedens*. One extralimital species (from Switzerland), *Calycellina triseptata*, is transferred as *Parachnopeziza triseptata*.

Early records of the Discomycetes of China date back to the end of the 19th century. Later, some pathogenic cup-fungi, as well as a few larger saprophytic species,

were reported (Tai, 1979), particularly in such genera as *Sclerotinia*, *Morchella*, and *Mitrula*. Though many specimens were collected after 1930, most of the taxonomic work was done by only a few mycologists, e.g., Ou (1936), Tai (1944), and Teng (1939, 1964). A total of 78 genera and 290 species and varieties of Discomycetes were listed in Tai's (1979) *Sylloge Fungorum Sinicorum*. More records have been added recently (Liou and Chen, 1977a, b; Zang, 1979; Wang and Zang, 1983; Korf and Zhuang, 1984). Seven new species, eight probable new species, and forty-two new records for China are reported here.

As part of a study of the fungal flora of China we have collected over 200 Discomycete specimens in Beijing and in Sichuan Province in the summers of 1981 (R.P.K.) and 1982 and 1983 (W.-y. Z.). Beijing is in the northern part of China, and was dry in those periods. Sichuan lies in southwest China, and the places where we collected are temperate, with a mild climate, high humidity, and altitudes ranging from 750 to 1200 meters. In order to clarify some misapplied names, some of the Chinese collections, primarily from the 1930's, which had been transferred to the Cornell University Plant Pathology Herbarium (CUP) during World War II were reexamined. The studies reported here are thus based primarily on our own collections (in CUP-CH and HMAS) and those at Cornell (CUP-CH), and several additional collections kindly sent to us by Professor Mu Zang, from Kunming (HKAS).

The species reported here are presented in four lists, in general following the classifications by Korf (1972, 1973): (1) new or provisional new species, (2) old species and infraspecific taxa new to the Chinese flora, (3) some species previously recorded from China for which name changes are necessary, and (4) taxa previously recorded from China, but new to Sichuan Province. Herbarium accession numbers in CUP, HKAS, and HMAS are provided, with full data for new taxa.

NEW OR PROVISIONAL NEW SPECIES

1. ARACHNOPEZIZA SUBNUDA Korf & Zhuang, sp. nov.

Fig. 1

A. nudae similis sed sporae semper ferme 1-septatae modo, fusoideae vel leviter curvatae vel latere uno com-



FIG. 1. *Arachnopeziza subnuda* (holotype). a, shape of apothecium, x 100; b, structure of apothecium, x 650; c, asci; d, paraphysis apices; e, ascospores. c-e, x 1000.

planatae, breviores angustioresque, 11.7-16.8 x 2.2-3.3 μm . pili similiter rara sed angustiores, 9-20 x 1.5-2.2 μm , in foliis defluxis reperta.

Apothecia discoid, scattered or gregarious, broadly sessile on the leaf surface, ca. 0.4-0.5 mm diam, yellow when fresh and pale brown when dry. **Subiculum** thin, white, closely appressed to the leaf surface, individual hyphae difficult to distinguish, obvious only near the base of the apothecium. **Ectal excipulum** of textura angularis, cells at flanks hyaline, 5.5-10.0 μm diam, towards the base giving rise to hyaline subicular hyphae 1.5-2.2 μm broad; basal cells above the leaf surface of pale brown-walled textura angularis, cells 3.0-4.5 μm diam. **Hairs** often absent, when present non-septate, apically cylindrical to subclavate, 9-20 x 1.5-2.2 μm . **Medullary excipulum** poorly developed, of textura angularis to textura intricata, hyphae 1.5-3.0 μm wide. **Subhymenium** not distinguishable. **Hymenium** ca. 70 μm thick. **Asci** inoperculate, J+ (pore wall blue in Melzer's Reagent), subclavate, 59-70 x 7.1-8.0 μm , mean 63.4 x 7.4 μm , 8-spored, arising from croziers, the ultimate cell of which only rarely fuses with the antepenultimate cell. **Ascospores** hyaline, fusoid, often slightly curved or with one surface flattened, one-septate, 11.7-16.8 x 2.2-3.3 μm , mean 14.8 x 2.7 μm , mostly biseriate. **Paraphyses** hyaline, subcylindrical, more or less rigid, ca. 2.2 μm wide, mostly 2-septate, golden-yellow in Melzer's Reagent, the apical cell staining strongly in Cotton Blue, the lower cells less so.

On lower surface of an undetermined, fallen leaf.

Holotype: Qingchengshan, Sichuan, W.-y. Zhuang, 6. VII. 1983 (HMAS 45091). **Isotype:** (CUP-CH 2510).

Notes: This species approaches *Arachnopeziza nuda* Korf in not having obvious hairs, but differs in microscopic details and its occurrence on a leaf from other described species (Batista et al., 1960; Batista and Bezerra, 1961; Dennis, 1961; Korf, 1952, 1959; Malençon and Bertault, 1958.)

2. CALYCELLINA (sp. nov.?)

We are unable to name a species with 3-septate ascospores collected by the senior author in Sichuan on a fern rachis (CUP-CH 2434). With some hesitation we refer this to *Calycellina* (see Lowen and Dumont, 1984). We have examined the type specimen on deposit at ZT of *C. triseptata* Raschle (1978), described from Switzerland on fern rachises, but that is quite different and is clearly a member of the *Arachnopezizoideae* (Korf, 1978).

It is transferred here as **PARACHNOPEZIZA TRISEPTATA** (Raschle) Korf, comb. nov., (basionym: *Calycellina triseptata* Raschle, Nova Hedwigia 30: 667. 1978.)

3. **COCCOMYCES MUCRONATUS** Korf & Zhuang, sp. nov.

Fig. 2

Ab Coccomycetis speciebus aliis polygonalibus vel subcircularibus forma paraphysium non-septatarum in gelatinam agglutinatarum et epithecium 20-25 μ m crassum

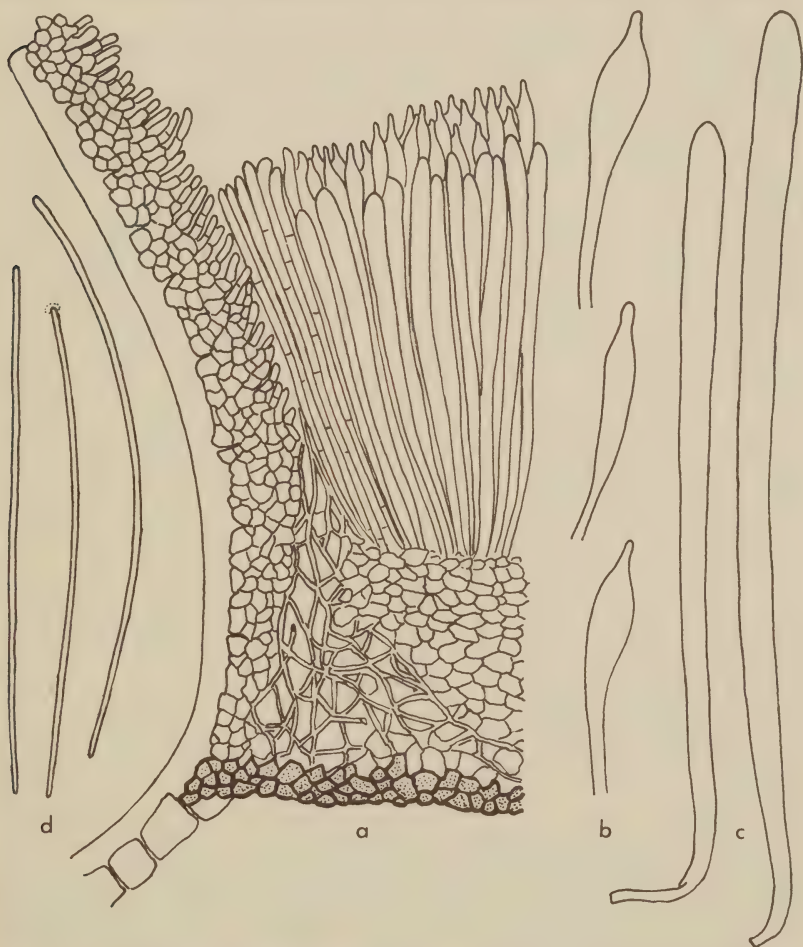


FIG. 2. *Coccomyces mucronatus* (holotype). a, structure of apothecium, x 400; b, paraphysis apices; c, asci; d, ascospores. b-d, x 1000.

formantium facile distinguendus, paraphysibus singulis superne ad 4.5–6.0 μm abrupte incrassatis et sub-fusoideo-ventricosis, ad apicem mucrone subcylindrico 1.6–2.0 μm lato praeditis.

Ascstromata produced separately on the leaf, epiphyllous (holotype) or hypophyllous (paratype), intraepidermal, polygonal to subcircular, 1.0–1.5 mm diam when dry, opening by 5–8 teeth to expose the lemon-yellow hymenium, the hymenium remaining luteus and exposed after drying, on rehydration the teeth opening widely and on sectioning the hymenium becoming strongly convex. **Stroma** with a covering layer and basal layer of dark, thick-walled cells forming a textura globulosa 15–20 μm thick, internal matrix of hyaline textura intricata, hyphae 1.1–1.5 μm broad, perhaps in a gel; **periphysoids** short, hyaline, one- or few-celled. **Apothecium** with a hyaline or light-colored proper exciple of textura porrecta, 15–35 μm wide, of hyphae similar to the paraphyses but septate and lacking an apical prolongation; the basal apothecial tissues of hyaline textura globulosa to textura angularis, cells ca. 3.5–7.5 μm diam; subhymenium not differentiated; hymenium ca. 155 μm thick. **Asci** cylindrical, (102–) 110–117 (–130) $\times$ 4.3–5.0 μm , 8-spored, ascus pore J– in Melzer's Reagent. **Ascospores** filiform, nonseptate, 70–84 $\times$ 0.6–0.8 μm , sheathed, some with a refractive cap covering the apex. **Paraphyses** nonseptate, cemented in a gel, forming an epithecium 20–25 μm thick, 2.2–2.7 μm wide below, abruptly enlarged to 4.5–6.0 μm and sub-fusoid-ventricose above, with a subcylindrical mucro 1.6–2.0 μm wide at the apex.

On fallen leaves of *Castanopsis* sp. and of *Quercus* sp.

Holotype: On fallen leaf of *Castanopsis* sp., Qingchengshan, Sichuan, W.-y. Zhuang, 6. VII. 1983 (HMAS 45058). **Isotype:** (CUP-CH 2484).

Paratype: On fallen leaf of *Quercus*, Along trail up Mt. Gedeh, Tjibodas, Java, Indonesia, K.P. Dumont & Nurta, 5. I. 1967 (CUP-SA 3030).

Notes: The mucro on the fusoid-ventricose paraphysis apices easily distinguishes this species from any others described (Butin and Speer, 1978; Dearness, 1917; DiCosmo et al., 1983; Sherwood, 1980; Vasilyeva, 1979). Its occurrence in both Sichuan and Indonesia suggests a wide-spread distribution in southern Asia,

where it should be sought on Fagaceae.

4. COCCOMYCES SICHUANENSIS Korf & Zhuang, sp. nov.

Fig. 3

Ab Coccomycetis speciebus aliis triangularibus vel tetragonis (e.g., C. delta et C. spgazzini) ascis et ascosporis brevioribus angustioribusque et paraphysibus plerumque trifurcatis septatis filiformibus apice aliquantum tumentibus distinguendus.

Ascstromata scattered in discolored areas of the leaf bounded with a black line, epiphyllous, subepidermal or possibly intraepidermal, triangular to tetragonous, exposing the greenish-gray hymenium when dry, 0.3–0.4 mm diam. **Stroma** with a covering layer and basal layer of dark, thick-walled cells, 10–20 (–24) μm thick, epidermal cells in covering layer often filled with dark fungal cells so that the stroma may appear to be subcuticular, with an internal matrix of compressed, hyaline textura angularis 12–15 μm thick. **Apothecium** lacking a proper exciple; hymenium hyaline, ca. 120 μm thick; subhymenium 9–12 μm thick, bounded below by a thin layer one or two cells thick of brown-walled hyphae running parallel to the leaf surface, below which is the stromal matrix. **Asci** cylindrical, 80–100 $\times$ 5.0–5.5 μm , 8-spored, ascus pore J– in Melzer's Reagent. **Ascospores** filiform, nonseptate, 65–80 $\times$ 0.8 μm , sheathed. **Paraphyses** filiform, septate, mostly trifurcately branched, somewhat swollen at the apices.

On the upper surface of a fallen leaf of ? *Ficus* sp.

Holotype: Qingchengshang, Sichuan, W.-y. Zhuang, 7. VII. 1983 (HMAS 45059). **Isotype:** (CUP-CH 2485).

Paratype: Qingchengshang, Sichuan, W.-y. Zhuang, 7. VII. 1983 (HMAS 45060). **Isoparatype:** (CUP-CH 2486).

Notes: This species is easily distinguished from other triangular to tetragonous species such as *Coccomyces delta* (Kunze) Sacc. and *C. spgazzinii* Sacc. by ascospore and paraphysis characters. The paratype, collected simultaneously, differs from the holotype in being hypophyllous, distinctly intraepidermal, somewhat smaller (0.2–0.3 mm diam), remaining closed (with a preformed opening mechanism) at maturity, and in possession of simple or occasionally dichotomous paraphysis apices (Fig. 3 e–g). Though these may eventually prove to be distinct taxa, we treat them both as conspecific for the time being.

5. COPROTUS (n. sp.?)

A collection on cow dung from Kiangsu (CUP-CH 257) identified as *Ascophanus granulatus* (Bull. : Fr.) Speg. appears to be a new species, not identifiable in the treatment by Kimbrough et al. (1972).

6. GEOPORA (n. sp.?)

We have been unable to place a species name on three collections (HMAS 45047, 45048, 45049) on soil made by the junior author at the Summer Palace, Beijing. These may represent one or more new species, but without the desperately needed monograph of *Geopora* we cannot go further.

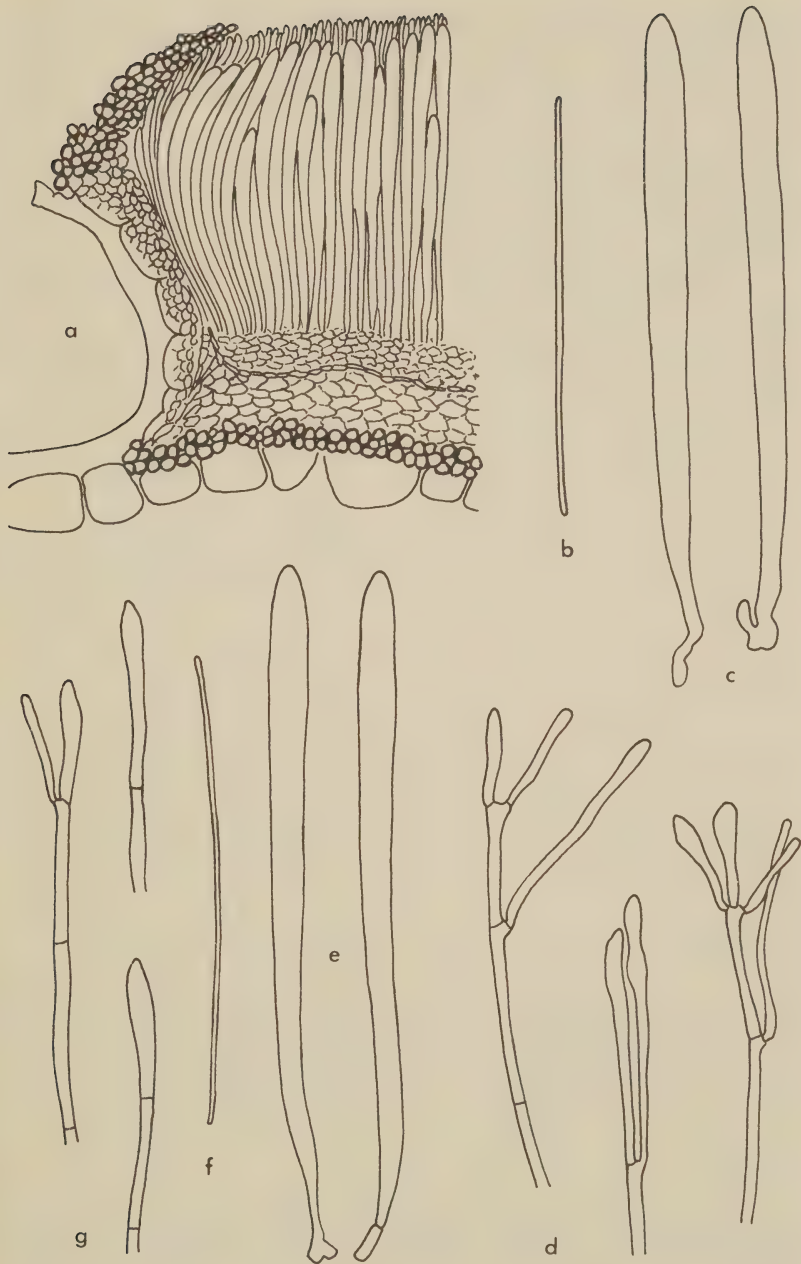
7. GYROMITRA SICHUANENSIS Korf & Zhuang, sp. nov.

Fig. 4

Ascocarpia morphologia grossa eis G. infulae similia, sed ascosporae biguttulatae (vel harum juventute guttulis pluribus irregularibus, maturitate velatis) 16.8-20.2 x 7.0-8.3 μ m notis obsitae subtilissimis aliquando tam ordinatis ut aggregationes cristoideas formant.

Ascocarp up to 6.5 cm diam when dry, hymenium dark sienna to umber, lower surface of pileus straw-colored, pileus lobed to saddle-shaped with free, often overlapping margins; stipe cylindrical, straw-colored, up to 3.5 cm high and 1.0 cm broad when dry. *Ectal excipulum* of textura intricata, hyphae hyaline, somewhat perpendicular to the outer surface of the pileus, fairly thick-walled and slightly refractive. *Medullary excipulum* of textura intricata, hyphae variable in diam, ectal and medullary excipula almost indistinguishable except near the margin. *Subhymenium* not sharply differentiated, though hyphae are more cyanophilic. *Asci* 8-spored, cylindrical, apex J- in Melzer's

FIG. 3. *Coccomyces sichuanensis*. a-d, holotype; e-g, paratype. a, structure of apothecium, x 400; b, ascospore; c, asci; d, paraphysis apices; e, asci; f, ascospore; g, paraphysis apices. b-g, x 1000.



Reagent, 180-190 x 11.7-14.5 μm , croziers not seen. **Ascospores** irregularly biseriate when young, uniseriate at maturity, ellipsoid, 16.8-20.2 x 7.0-8.3 μm , biguttulate or with several small, irregular guttules in youth, guttules masked at maturity, mature spore walls with very fine cyanophilic markings densely placed, occasionally arranged to form crest-like aggregations. **Paraphyses** filiform, septate, slightly swollen and deformed at the apex, 4.5-6.5 μm wide at the apex, 4.0-5.8 μm wide below.

Associated with *Picea likiangensis* (Franch.) Pritz. var. *balfouriana* (Rehd. & Wils.) Hillier ex Slavin and with *Quercus pannosa* Hand.-Mazz.

Holotype: Wugen Mts., Xiangchen County, Sichuan, 3600 m elev., Xing-jiang Li, 12. VIII. 1981 (HKAS 8331). **Isotype:** (CUP-CH 2522).

Paratype: Xiangcheng County, Sichuan, 3500 m elev., Xing-jiang Li, 12. VIII. 1981 (HKAS 8605). **Isoparatype:** (CUP-CH 2523).

Notes: The peculiarly marked ascospores and somewhat smaller stature distinguish this species easily from *Gyromitra infula* (Schaeff. : Fr.) Quél. and its allies.

8. HYMENOSCYPHUS (sp. nov.?)

A collection taken by the senior author on tree fruits on soil in Qingchengshan, Sichuan (CUP-CH 2396) recalls *Hymenoscyphus dearnessii* (Ell. & Everh.) Kuntze in spore morphology, but the ectal excipulum is of *textura angularis*, not *textura prismatica* as illustrated by Dumont (1981b) and by White (1944). It may well be undescribed.

9. LAMBERTELLA RUBI Korf & Zhuang, sp. nov. ined.

A key to all the known species of *Lambertella* has been prepared (Korf & Zhuang, 1985), in which we describe and illustrate this species on the leaf blades of *Rubus pinfaensis* H. Lév. & Vaniot. The holotype will be distributed in Korf & Gruff, *Discomycetes Exsiccati*.

10. MOELLERODISCUS (sp. nov.?)

A collection from Sichuan by the junior author, on a fallen leaf (HMAS 45083), closely resembles *Moellerodiscus* "sp. 1881" as described by Kohn (1982). It does

not fit any of the species treated by Dumont (1976a, b), or Kohn (1982).

11. PACHYELLA (sp. nov.?)

A collection from Yen-hsien, Hainan (CUP-CH 322) served as the basis for Teng's (1934, 1939) reports of *Psilopezia aquatica* (DC.) Rehm. We consulted Professor Donald H. Pfister, Farlow Herbarium, on its identity and he indicates that it is a species near *Pachyella punctispora* Pfister. It differs from that species in much



FIG. 4. *Gyromitra sichuanensis* (holotype). a, structure of the excipulum, x 400; b, paraphysis apices, x 1000; c, two immature ascospores in optical section, one mature ascospore in surface view, x 1500.

smaller apothecia (dry 2.8 mm vs 10 mm), slightly smaller spores, and slightly larger markings, and also does not seem to fit any of the other species described by Pfister (1973, 1976a) or Pfister and Candoussau (1981).

12. PLECTANIA sect. PLECTANIA (sp. nov.?)

An old collection from Yunnan (CUP-CH 938) identified as *Bulgaria melastoma* (Sow.) Seav. is clearly a species of *Plectania* sect. *Plectania*. Though it keys to *P. mexicana* (Ell. & Holw. in Holw.) Paden in Paden's (1983) key, it is surely distinct from that, based on our comparison with specimens kindly provided by Prof. Paden.

13. PLECTANIA sect. SPHAEROSPORAE (sp. nov.?)

Two collections, CUP-CH 1611 and 1662, from Sikang probably are the basis for Teng's (1939) report of *Pseudoplectania nigrella* (Pers.) Fuckel. We agree with Karsten (1885) and Paden (1983) in merging *Pseudoplectania* in *Plectania*. These collections may represent an as yet undescribed Asian taxon.

14. PSILACHNUM MICROALLANTOSPORUM Korf & Zhuang, sp. nov. Fig. 5

Ab Psilachni speciebus aliis in rhachidibus filicum repertis differt ascosporis leviter allantoideis vel bacilliformibus (aliquibus ad unam extremitatem parum latioribus) 3.5-4.0 x 0.8-1.0 μ m, in ascis minutis 8-sporis 23.5-28.0 x 3.0-3.7 μ m.

Apothecium discoid, short-stipitate, less than 0.5 mm diam, stipe about equal in length to diameter of disc, when dry hymenium and receptacle concolorous, yellowish beige to light flesh color, stipe usually darker, receptacle surface downy. **Ectal excipulum** of textura prismatica, cells largest at the flanks near the junction with the stipe, smaller towards the margin, outermost cells giving rise to smooth, hair-like hyphal protrusions ca. 7.5-14.0 μ m long, cylindrical or slightly swollen at the apices. **Medullary excipulum** of tightly interwoven textura intricata. **Subhymenium** indistinguishable from the medullary excipulum. **Hymenium** ca. 27 μ m thick. **Asci** clavate, inoperculate, J+ (pore wall blue in Melzer's Reagent), 8-spored, 23.5-28.0 x 3.0-3.7 μ m. **Pa-**



FIG. 5. *Psilachnum microallantosporum* (holotype). a, structure of ectal excipulum; b, asci; c, ascospores. All $\times 1000$.

rachyses filiform, simple, ca. $1.0\ \mu\text{m}$ wide, not exceeding the asci. **Ascospores** hyaline, faintly allantoid to rod-shaped, some slightly broader at one end, non-septate, uniseriate to biseriate, $3.5\text{--}4.0 \times 0.8\text{--}1.0\ \mu\text{m}$.

On the base of fern rachises.

Holotype: Qingchengshan, Sichuan, R.-y. Zheng & R. P. Korf, 19. IX. 1981 (CUP-CH 2430).

Notes: The spore shape distinguishes this *Psilachnum* from other species of the genus (Bøhler, 1974; Dennis, 1962, 1963, 1964; Graddon, 1974, 1977; Müller, 1967; Raitviir, 1970; Svrček, 1977, 1979).

15. *TRICHOPHAEA GEOPOROIDES* Korf & Zhuang, sp. nov.

Fig. 6

Ab Trichophaeae speciebus aliis differt margine et lateribus setis laevibus et ad apicem pustulae excipularis saepe confertis praeditis, basi pilis plus minusve cylindricis saepe flexuosis longitudinem secus granulis incrustatis sed ad apicem et ad imam basem plerumque laevibus praedita, atque ascosporis ellipsoideis biguttulatis $18.3\text{--}22.7 \times 8.8\text{--}12.0\ \mu\text{m}$ non bullas ab nomine DeBary appellatas formantibus, in hoc caractere speciebus generis Geoporae similis.

Apothecia ca. 4-6 mm diam, at first concave, becoming scutellate or discoid at maturity, somewhat pustulate externally, with brown hairs on the lower surface and margin; hymenium whitish. **Ectal excipulum** 100-150 μm thick, of *textura globulosa*, cells spherical to ovoid, (12-) 25-38 (-47) μm diam, brown-walled in the outermost 2 to 5 layers, hyaline in inner layers. **Medullary excipulum** of a hyaline *textura intricata*, hyphae of great variability in width, up to 150 μm thick. **Subhymenium** indistinguishable from the medullary excipulum. **Hairs** of two kinds, arising from the ectal excipular cells: (1) stiff, setaceous, smooth, (55-) 200-270 (-338) $\times$ (8.0-) 10.0-12.5 (-15.0) μm at the widest part, with fairly thick, light brown walls, septa only slightly thinner than the hair walls, the hairs often clustered at the apex of an excipular pustule and produced at the margin and flanks, and (2) often flexuous, more or less cylindrical, granularly encrusted along their length except at the very base and often also smooth at the apex, 213-750 $\times$ 5.0-8.0 μm , thinner-walled, light brown-walled, septa very thin, these hairs produced mainly at the base where they enmesh soil particles, fewer on the flanks where interspersed with setaceous hairs. **Asci** operculate, cylindrical, (170-) 200-225 (-250) $\times$ 13-15 μm , J- (apex not blue in Melzer's Reagent). **Ascospores** ellipsoid, appearing smooth-walled, with a strongly cyanophilic inner wall layer, eventually with small, very faint, cyanophilic markings at the limit of resolution under oil immersion, usually biguttulate in youth, sometimes with more than 2 guttules, often with a single, irregular guttule at maturity, 18.3-22.7 $\times$ 8.8-12.0 μm , thin-walled, not forming de Bary bubbles. **Paraphyses** filiform, 2.8-3.2 μm wide, about as long as the asci, slightly swollen or deformed at the apices, septate.

On soil.

Holotype: Summer Palace, Beijing, W. Tang & W.-y. Zhuang, 30. VIII. 1982 (HMAS 45044). **Isotype:** (CUP-CH 2471).

Notes: This species is in some ways intermediate between *Trichophaea* and *Geopora*. The smooth-walled setaceous hairs at the margin and flanks would be typical of *Trichophaea*, but no de Bary bubbles form in the ascospores. Granularly roughened basal hairs enmeshing soil particles fit *Geopora*, but no species we know also has smooth-walled, setaceous hairs. Rather than erect a new genus for this fungus, we describe it

in *Trichophaea* until cultural studies demonstrate it cannot be accommodated there. None of the species treated by Kanouse (1958), Pfister (1982), and others we have searched combine such characters.

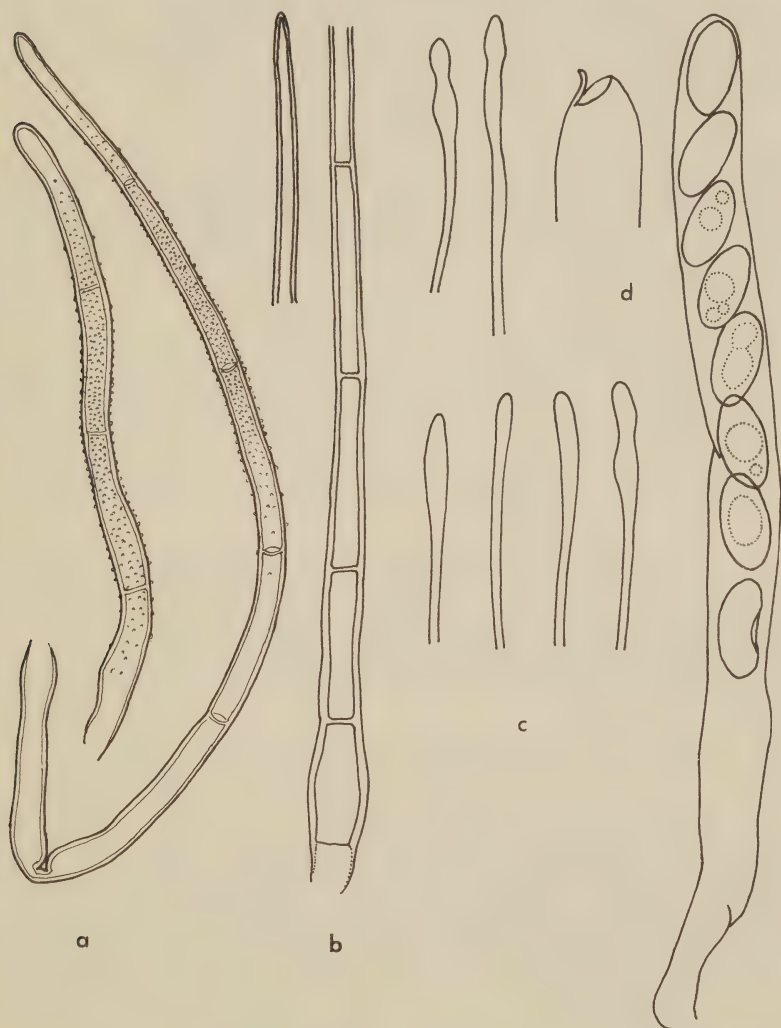


FIG. 6. *Trichophaea geoporoides* (holotype). a, granulate basal hairs; b, basal and apical part of seta; c, paraphysis apices; d, ascus apex showing operculum, and ascus containing ascospores. All x 650.

NEW RECCRDS FOR CHINA

16. *Acervus epispertius* (Berk. & Br.) Pfister

The distribution of this interesting fungus has recently been reviewed by Pfister (1975) and Pfister and Bessette (1985). It was collected on soil and also photographed by the senior author in Sichuan (CUP-CH 2320).

17. *Aleuria rhenana* Fuckel

This distinctive species was collected in Sichuan and sent to us by Dr. Zang (HKAS 8644). It has been discussed by Breitenbach & Kränzlin (1981), Heim (1961), and Rifai (1968).

18. *Arachnopeziza cornuta* (Ellis) Korf

This was collected by the junior author in Sichuan (HMAS 45062) on wood, and was earlier described by Korf (1952).

19. *Byssonectria aggregata* (Berk. & Br.) Rogerson & Korf in Korf

This species was collected by the junior author in Sichuan on soil (HMAS 45053). The combination was made by Korf (1971). Rifai (1968) included this within his concept of *Inermisia fusispora* (Berk.) Rifai, but we think *B. fusispora* (Berk.) Rogerson & Korf in Korf is distinguishable.

20. *Calycellina carolinensis* Nag Raj & Kendrick

A collection on an unidentified leaf in Sichuan by the senior author (CUP-CH 2383) extends the range from the two previously reported stations, one in North Carolina, one in New Zealand (Nag Raj and Kendrick, 1975). The anamorphic state previously reported as associated, *Chaetochalara aspera* Pirozynski & Hodges, is also abundant in our material, confirming the identification beyond doubt.

21. *Calycellina* cfr. *minuta* Thind & Sharma

One of the senior author's collections on fern pinnae from Sichuan (CUP-CH 2429) we have tentatively

identified as this species, originally described from India. We have not seen the type specimen of Thind and Sharma's (1980) species, nor apparently have Lowen and Dumont (1984).

22. *Ciboria peckiana* (Cooke) Korf forma *peckiana*

The senior author has made two collections of this common species in Sichuan (CUP-CH 2332, 2374). It was treated as *Rutstroemia macrospora* (Peck) Kanouse in Wehmeyer by White (1941), but the name change was necessary when placed in *Ciboria* (Korf, 1971). Arendholz and Sharma (1984) have recently reported *C. peckiana* f. *gigaspora* (Korf) Korf from India.

23. *Claussenomyces* cfr. *dacrymycetoideus* Ouell. & Korf

This collection, on a living twig of *Larix gmelinii* Ledeb. ex Gordon was collected in Daxinganling, Nei-menggu by Jian-yu Yun, and identified by the senior author while he was in Beijing. We can no longer find apothecia on the portion of the collection at Cornell (CUP-CH 2293). This was described by Ouellette and Korf (1979) from Macaronesia.

24. *Crocicreas cyathoides* (Bull. : Fr.) Carpenter var. *cyathoides*

The junior author has collected this common species on an unidentified herbaceous stem in Sichuan (HMAS 45064). We have followed the monograph by Carpenter (1981).

25. *Galiella javanica* (Rehm in Henn.) Nannf. & Korf in Korf

A collection (CUP-CH 630) from Tan-hsien, Hainan was originally identified as *Bulgaria melastoma* (Sow.) Seaver, but proves to be this fairly common, Asian tropical species well described by Le Gal (1953) and transferred by Korf (1957).

26. *Greletia planchonis* (Dun. ex Boud.) Donadini

The junior author collected this species on soil in Sichuan (HMAS 45038). It has been placed in various genera, including *Plicaria*. We accept *Greletia* as distinct from *Marcelleina* (= *Pulparia* sensu Korf, et al.,

non sensu Karsten). For treatments see Boudier (1905-1911), Donadini (1976, 1979), Korf (1971), and Rifai (1968).

27. *Hymenoscyphus eburneus* (Rob.) Phill.

The senior author's collection from Sichuan on basal culms of living clumps of a large grass (CUP-CH 2349) fits the description in Dennis (1956) well.

28. *Hymenoscyphus sclerogenus* (Berk. & Curt. in Berk.)
Dennis

Two collections by the junior author from Sichuan, on stems of *Rubus* and on a herbaceous stem (HMAS 45092, 45093) are referable to this common tropical species as interpreted by Dennis (1962), by Dumont (1981a, 1981b), and Dumont and Carpenter (1982).

29. *HYMENOSCYPHUS SCUTULA* (Pers. : Fr.) Phill. var.
SOLANI (Karst.) Korf & Zhuang, comb. nov.

Basionym: *Helotium scutula* (Pers. : Fr.) Karst.
[var.] *** *solani* Karst., Not. Sällsk. Fauna Fl. Fenn.
Förh. 11: 234. 1870.

Collected in Sichuan by the senior author on unidentified stems and on stems of *Polygonum cuspidatum* Sieb. & Zucc. (CUP-CH 2388, 2413). The treatment in Dennis (1956) is followed here.

30. *Jafneadelphus ferrugineus* (Phill. in Cooke) Rifai
subsp. *imaii* (Korf) Rifai

Both of us collected this subspecies on soil in Sichuan, thus extending its known distribution from Japan (CUP-CH 2333, 2372, 2403, HMAS 45039, 45040, and probably several other collections which are not mature). A submonographic study of this genus is in preparation in our laboratory. For our purposes here, we follow the treatment by Rifai (1968). This taxon was given species rank originally, in *Jafnea* (Korf, 1960).

31. *Lachnum ciliare* (Schröd. : Fr.) Rehm

The senior author collected this on a leaf blade in Sichuan (CUP-CH 2437). Dennis (1949) has a good description.

32. *LACHNUM FLAVIDULUM* (Rehm) Haines, **comb. nov.**,
var. *FLAVIDULUM*

Basionym: *Dasyscyphus flavidulus* Rehm ('*Dasyscypha flavidula*'), Ann. Mycol. 7: 542. 1909.

Previously reported from the Neotropics, Hawaii, New Guinea and New Zealand as *Dasyscyphus varians* Rehm var. *variens* (Haines, 1980), an earlier taxonomic synonym. Since *Lachnum* is now the generic name of choice, the more recent epithet must be adopted to avoid homonymy. We have both collected this common species in Sichuan, on twigs, rachises of *Dicranopteris dichotoma* (Thunb.) Bernh. and unidentified fern rachises (CUP-CH 2414, 2417; HMAS 45063).

33. *Lachnum pygmaeum* (Fr. : Fr.) Bresadola

The junior author's collection from Sichuan is, as is typical of the species, on a root (HMAS 45073). Good descriptions are to be found in Dennis (1949) and White (1942).

34. *LACHNUM TENUISSIMUM* (Quél.) Korf & Zhuang, **comb. nov.**

Basionym: *Peziza tenuissima* Quél., Grevillea 8: 38. 1879.

Two collections on grasses were made by the senior author in Sichuan (CUP-CH 2331, 2340). This was treated in *Dasyscyphus* by Breitenbach and Kränzlin (1981), Dennis (1963) and Raitviir (1970), but is much better known under the name of *D. pudicellus* (Quél.) Sacc. (Dennis, 1949; Luijt-Verheij, 1973).

35. *Lambertella buchwaldii* Tewari & Singh

The junior author's collection on rootlets in Sichuan (HMAS 45080) fits the original description (Tewari and Singh, 1972) fairly well, but we find no mature, brown ascospores in the Chinese specimen, and the margin is not crenate.

36. *Lambertella copticola* Korf & Tewari in Tewari

The senior author's two collections on stromatized leaves from Sichuan differ: in CUP-CH 2360 the inner

ectal excipulum and medullary excipulum do not turn blue in Melzer's Reagent, while in CUP-CH 2369 both react strongly. In microscopic features both collections fit *L. copticola* closely, and we are not placing much weight on this character. Dumont (1971) has a good description.

37. *Lambertella corni-marisi* Höhnelt

The collection by the senior author on the husk of a (tree?) fruit in Sichuan (CUP-CH 2371) seems to match this species well, as delimited by Dumont (1971).

38. *Lambertella zeylanica* Dumont

We are referring three specimens collected by the senior author in Sichuan to this name, though only CUP-CH 2327 on a leaf blade fits well. In CUP-CH 2424 and 2425 from the same area, on obvious line stromata on leaves, the hairs instead of being narrowed and thread-like, are swollen apically with a rounded apex. It is possible they represent a different taxon.

39. *Melastiza rubra* (Batra) Maas Geesteranus

Two collections, CUP-CH 2288 and 2289 (a specimen planned for issue in *Discomycetes Exsiccati*), were taken on soil along a path in the Beijing area by the senior author. Maas Geesteranus (1967) has a good description.

40. *Micropyxis geoglossi* (Ell. & Everh.) Seeler

This parasite on the hymenium of *Trichoglossum walteri* (Berk.) Durand was collected by the senior author in Sichuan (CUP-CH 2408). For descriptions and comments, see Pfister (1976b) and Seeler (1943).

41. *Nanoscypha pulchra* Denison

The senior author's collection (CUP-CH 2394) on decaying leaves of *Cupressus* in Sichuan extends distribution from Costa Rica, Central America (Denison, 1972).

42. *Orbilia auricolor* (Bloxam ex Berk.) Sacc.

This very characteristic species (Dennis, 1978) was picked up by both of us in Sichuan on a rotted stump and on wood (CUP-CH 2313, HMAS 45087).

43. *Orbilia xanthostigma* (Fr. : Fr.) Fr.

We are using this name in the sense of Svrček (1954) for two collections made on wood in Sichuan by the junior author (HMAS 45084, 45085).

44. *Peziza atrospora* Fuckel

A collection by the junior author on soil in Beijing (HMAS 45033) fits the description and treatment by Maas Geesteranus (1969).

45. *Peziza michelii* (Boud.) Dennis

A collection on soil from Sichuan by the junior author (HMAS 45034) fits the concepts of Dennis (1960), Donadini (1981), and Le Gal (1941).

46. *Peziza subumbrina* Boud. in Cooke

A Sichuan collection on soil taken by the junior author (HMAS 45035) agrees with the treatments by Donadini (1981) and Le Gal (1941).

47. *Peziza succosella* (Le Gal & Romagnesi) Moser

The junior author collected this species on soil in Sichuan (HMAS 45036). Compare Donadini (1981) and Le Gal (1941).

48. *Peziza* cfr. *thozetii* Berk.

There is clearly some confusion about the identity of specimens classified near *P. thozetii* (see Hirsch, 1984; Moravec, 1984; Rifai, 1968), and we cannot reach any definitive name for our material, collected by the senior author on duff of *Chamaecyparis* in Sichuan (CUP-CH 2391).

49. *Pseudopithyella minuscula* (Boud. & Torrend) Seaver

Two collections on leaves of *Biota orientalis* (L.) Endl. (a new substrate) in Beijing by the junior author (HMAS 44074, 44075) extend the range of this easily recognized species with its peculiar ascus apices, well described and illustrated by Seaver (1928, 1942).

50. *Psilachnum* cfr. *chrysostigmum* (Fr. : Fr) Raitviir

A collection on a fern rachis in Sichuan by the senior author (CUP-CH 2419) has smaller spores than described by Bøhler (1974) or by Raitviir (1970).

51. *Scutellinia minutella* Svrček & Moravec

Collected by the junior author in Sichuan on soil (HMAS 45050). See Svrček and Moravec (1969).

52. *Scutellinia subcervorum* Svrček

Another soil collection by the junior author in Sichuan (HMAS 45052). Compare Kullman (1982) and Svrček (1971),

53. *Scutellinia subhirtella* Svrček

A third soil-inhabiting species from Sichuan, collected by the junior author (HMAS 45051). The treatments by Kullman (1982) and Svrček (1971) are useful.

54. *Stictis hydrangeae* Schw.

The collection by the senior author on an unidentified twig in Sichuan (CUP-CH 2379) appears to fit the description by Sherwood (1977), and represents a range extension beyond North America and Europe.

55. *Stictis radiata* Pers.

A collection from Sichuan on an unidentified twig made by the junior author (HMAS 45056) fits the treatments in Johnston (1983) and Sherwood (1977).

56. *Trichoglossum walteri* (Berk.) Durand

This species was collected commonly in Sichuan on soil by the senior author (CUP-CH 2343, 2365, 2397, 2399, 2404, 2407, 2408, 2409). It is somewhat surprising that it has not been reported before from China (Maas Geesteranus, 1965; Mains, 1954; Tai, 1944), but it may have been reported under some other epithet. Ascocarps parasitized by *Micropyxis geoglossi* were also found (see No. 40 above).

57. *Trichophaea woolhopeia* (Cooke & Phill.) Boud.

The junior author collected this on soil in Sichuan (HAMS 45045). We accept the treatments by Boudier (1905-1911) and Pfister (1982), and place in synonymy *T. bullata* Kanouse (1958).

58. *Unguiculariopsis hysterigena* (Berk. & Br.) Korf

Two collections, both from Ling-shui, Hainan, were found on old collections of *Rhytidhysterium rufulum* (Spreng. : Fr.) Speg. [CUP-CH 259, 857, both as *Tryblidiella rufula* (Spreng.) Sacc.], overlooked by the collectors when collecting the host fungus. The species was originally described from Ceylon (Berkeley and Broome, 1873), and was transferred to *Unguiculariopsis* by Korf (1971). This material clearly matches the type specimen, and represents a major extension of range.

PREVIOUSLY REPORTED SPECIES
FOR WHICH NEW NAMES ARE REQUIRED

59. *Bisporella discedens* (Karst.) Carpenter

Ou (1936) and Teng (1939) reported a collection from Chekiang (CUP-CH 939) as *Orbilia sinuosa* Penz. & Sacc., but our examination of the specimen shows it is clearly the fungus that Carpenter (1975) calls *B. discedens*. The *Cystodendron* anamorph described by Carpenter is present in this material, and the asci are far too large for this to be Penzig and Saccardo's species. Since this collection appears to be the only report of *O. sinuosa* from China, that species should apparently be struck from the records of Chinese fungi. Whether *B. discedens* can really be distinguished from the very common *B. sulfurina* (Quélet.) Carp. in Korf & Carpenter (1974) is still open to question, but if not, the Quélet epithet would have priority.

60. *Chlorosplenium chlora* (Schw. : Fr.) Curtis in
Sprague

Judging by Teng's identifications (CUP-CH 19, 48, 2169) as cited in Teng (1934) and one of his later collections (CUP-CH 2167), his various reports in the Chinese literature of the occurrence of *Mollisia viridulomellea* Penz. & Sacc. are based on specimens better

referred to *C. chlora* as delimited by Dixon (1974). The species appears to be widespread in Asia. Neither Dixon (1974, 1975) nor we have examined Penzig and Saccardo's type specimen to see if it is a later synonym of *C. chlora* or some other fungus. *M. viridulo-mellea* should be struck from the Chinese flora lists as either a later synonym or a misidentification.

61. *Lachnum abnormis* (Mont.) Haines & Dumont

We have examined the isotype specimen of *Erinella sinensis* Teng (CUP-CH 253) and have also consulted with Dr. John Haines, New York State Museum, who agrees with us that Teng's species is a new, later synonym of Montagne's species. The name *E. sinensis* as reported by Teng (1934, 1939) should be dropped from the Chinese flora, and replaced with *L. abnormis* as delimited by Haines and Dumont (1984). We have a number of collections from Sichuan (CUP-CH 2370, HMAS 45065-45072).

62. *LACHNUM JAVANICUM* (Henn. & Nym. in P. Henn.)
Haines, Korf, & Zhuang, **comb. nov.**

Basionym: *Erinella javanica* Henn. & Nym. in P. Henn., *Monsunia* 1: 32. 1899.

Dr. Haines has confirmed our identification of an old collection from Ling-shui, Hainan on wood (CUP-CH 1285) as *E. javanica*, but the necessity to abandon *Erinella* and to adopt *Lachnum* instead requires this name change. It fits Saccardo's (1902) description well.

63. *LANZIA SEROTINA* (Pers. : Fr.) Korf & Zhuang,
comb. nov.

Basionym: *Peziza serotina* Pers., *Syn. Method. Fung.* p. 661. 1801; : Fr., *Syst. Mycol.* 2: 119. 1822.

The senior author has collected this species extensively in Sichuan (CUP-CH 2355, 2366, 2368, 2373, 2378). It has been reported from China as *Helotium serotinum* (Pers. : Fr.) Fr. (Tai, 1979). An important paper on this species is by Dumont and Carpenter (1982), but despite their familiarity with the Sclerotiriaceae and with *Lanzia*, they have referred the species to *Hymenoscyphus*, as *H. serotinus* (Pers. : Fr.) Phill. We find the structure of the apothecium to be as they and other

authors illustrate, but that not infrequently a very evident stroma is to be found in the host tissue. We conclude that the fungus must be removed from *Hymenoscyphus* and placed in the Sclerotiniaceae. We believe that the recently transferred *Lanzia vacini* (Velen.) Spooner in Kirk & Spooner (1984) is merely a collection of *L. serotina* in which Spooner correctly noted the stroma, and that Velenovský's species is probably a later synonym of Persoon's, though we have not examined the Velenovský type.

64. *OTIDEA PURPUREA* (Zang) Korf & Zhuang, comb. nov.

Basionym: *Acetabula purpurea* Zang, Acta Bot. Yunnanica 1: 101. 1979.

The biguttulate ascospores, apically hooked paraphyses (not noted in the original description), and ectal excipulum of textura angularis, coupled with the slightly unequal-sided apothecia, leave no doubt that this species must be referred to *Otidea*, not to *Acetabula* (= *Helvella*). We have examined the type specimen (HKAS 5670) from Xizang (Tibet), kindly communicated by Professor Zang. It appears to be quite distinct from any other species of *Otidea* yet described. The original figure (Zang, 1979) has been republished in Wang and Zang (1983).

PREVIOUSLY REPORTED SPECIES FROM CHINA
NEW TO SICHUAN PROVINCE

65. *Geoglossum umbratile* Sacc.

The senior author's collections (CUP-CH 2402, 2432) show this also to be present in Sichuan.

66. *Lachnum* cfr. *nudipes* (Fuckel) Nannf.

The senior author's collection on a (herbaceous?) stem from Sichuan (CUP-CH 2421) differs from typical material in paraphyses that do not exceed the asci as much as usual, in somewhat shorter ascospores, and in the absence of crystals at the tips of hairs, so often present in *L. nudipes*. We only provisionally identify it, following the treatments of Dennis (1949), Liou and Chen (1977a), Luijt-Verheij (1973), and Raitviir (1970).

67. *Lachnum virgineum* (Batsch : Fr.) Karst.

This widespread species is represented by many Sichuan collections (CUP-CH 2310, 2311, 2334, 2336, 2353, 2354, 2363, 2381, 2439; HMAS 45074-45077). In much of the literature this species is placed in *Dasyscypha* or *Dasyscyphus*.

68. *Lanzia rufo-cornea* (Berk. & Br.) Dumont

In much of the literature this common tropical species is referred to as *Helotium subserotinum* P. Henn. & Nym. in Henn., but as Dumont (1980) has shown, the Berkeley and Broome epithet has priority, and this name should replace that in the Chinese floras. We have both collected this discomycete in Sichuan, and these collections extend the distribution to that province (CUP-CH 2303, 2314, 2319, 2328, 2345, 2359, 2386; HMAS 45081).

69. *Leotia lubrica* (Scop. : Fr.) Pers.

The senior author's collections (CUP-CH 2344, 2406) extend the distribution of this exceptionally common fungus to Sichuan.

70. *Trichoglossum hirsutum* (Pers. : Fr.) Boud.

A collection (CUP-CH 2398) by the senior author adds Sichuan to the known distribution of this common species.

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REVUE DES LIVRES

par

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FUNGI PATHOGENIC FOR HUMANS AND ANIMALS, PART A. BIOLOGY, éd. par D.H. HOWARD et L.F. HOWARD, Mycology Series (P.A. Lemke, éd.) vol. 3A, xiv + 652 p., ill., 4° (18x25 cm), relié cartonné. 1983. Marcel Dekker Inc. Publ., 270 Madison Ave, New York, NY 10016, USA. Prix: US \$ 225.-

Cet ouvrage en 3 volumes dont deux sont parus, est conçu d'un point de vue large et approfondi à la fois, de telle manière que le chercheur comme l'étudiant y trouvera la mise à jour de ses connaissances sur les champignons médicalement importants sous tous leurs aspects tant mycologiques que médicaux.

Le premier volume couvre les récentes acquisitions en matière de systématique de classification et de nomenclature des champignons pathogènes, grâce à la contribution de spécialistes de chaque groupe. Dans les mucorales sont passées en revue principalement *Rhizopus*, *Absidia*, *Rhizomucor*, *Mucor* et quelques autres. Des entomophtorales, on retient *Basidiobolus* et *Conidiobolus*. Parmi les Ascomycètes traités, citons les *Ajellomyces*, *Emmonsia* (*Histoplasma*), *Eurotium*, *Emericella*, *Neosartorya*, *Microascus* (*Scopulariopsis*), *Pithoascus*, *Petriellidium* (*Allescheria*), *Leptosphaeria* et *Pierdraia*. Les dermatophytes, traités par D.H. Howard lui-même, sont groupés en pathogènes et en saprophytiques. Lorsqu'il est connu, c'est le nom de téléomorphe qui est utilisé. Treize genres d'hyphomycètes dématés potentiellement pathogènes sont encore décrits et illustrés, en particulier les *Cladosporium*, les *Exophiala*, les *Ochroconis*, les *Rhinocladiella* et d'autres. Il est utile que soient ainsi mises à jour la taxonomie et la nomenclature des champignons pathogènes sur lesquelles trop de confusion a longtemps subsisté.

Après un chapitre sur l'ultrastructure de la cellule, un intéressant chapitre, par P.J. Szaniszló, sur le dimorphisme, montre bien que la diversité des formes selon les conditions de vie parasitaire ou saprophytes dépend bien de celles-ci. Les formes ne sont pas considérées comme des synanamorphes ni dénommées. Au contraire, les mécanismes biochimiques de passage de l'une à l'autre sont largement étudiés. G.T. Coole illustre ensuite la conidiogénèse et la sporangiosporogénèse des hyphomycètes et mucorales. Après un petit chapitre sur la germination des conidies, la cinétique des transports d'ions et de métabolites vers ou de la cellule ouvre la porte à l'étude de la pharmacodynamie.

FUNGI PATHOGENIC FOR HUMANS AND ANIMALS, PART B. PATHOGENICITY AND DETECTION (1), éd. par D.H. HOWARD et L.F. HOWARD, Mycology Series (P.A. Lemke, éd.) vol. 3B, xiv + 544 p., ill., 4° (18x25 cm),

relié cartonné. 1983. Marcel Dekker Inc. Publ. 270 Madison Ave, New York, NY 10016, USA. Prix: US \$ 190.-

Cette seconde partie de l'ouvrage concerne à la fois les mécanismes de pathogénèse et la réaction immunitaire à l'infection, les moyens de détection et de diagnose et enfin l'action des médicaments. A cela s'ajoutent deux chapitres sur les champignons toxiques.

Les mécanismes de pathogénèse sont traités par voie d'exemples: la paracoccidioidomycose, la lobomycose, la coccidioidomycose, l'histoplasme, la sporotrichose, la candidose, la cryptococcose. Sont étudiées ensuite l'immunité cellulaire CMI, sa mise en évidence dans les mycoses et sa disparition, et la réponse immunitaire par anticorps. D.W.R. Mackenzie donne alors un long chapitre sur la diagnose sérologique des mycoses par l'étude des antigènes et des anticorps tandis que M. Huppert revoit l'usage d'antigènes et P.F. Lehmann détermine les métabolites fongiques dans le corps, y compris les antigènes, en vue du diagnostic. Ces chapitres constituent un des centres d'intérêt du livre, mais les deux derniers chapitres sur les champignons toxiques d'une part et les mycotoxines présentes dans les denrées alimentaires retiendront une large audience. Là, c'est la nature chimique des substances toxiques qui constitue la trame de ces chapitres. Par les mycotoxicoses trop souvent fatales que ces substances provoquent, il est heureux qu'elles aient été revues dans cet ouvrage surtout destiné aux gens du domaine médical.

THE GENERA OF MYXOMYCETES par G.W. MARTIN, C.J. ALEXOPOULOS et M.L. FARR. xii + 562 p., 41 planches couleurs, 8° (18x25cm), relié toilé, 1983. University of Iowa Press, Iowa City, Iowa 522 42, USA. Prix: US \$ 35.-

Ce livre est un complément de mise à jour du livre de Martin et Alexopoulos *THE MYXOMYCETES*, paru aux mêmes éditions en 1969. Dr. Farr a, en effet, pu réunir une somme abondante d'informations nouvelles, surtout d'intérêt taxonomique, mais aussi d'intérêt général, sur la physiologie et la culture in vitro des myxomycètes.

Que ce soit au sujet des clés d'identification, des familles et des genres, elle ajoute des commentaires d'ordre morphologique, taxonomique, écologique, floristique, insistant sur les connaissances nouvelles acquises depuis 20 ans, représentés par une longue bibliographie. L'ouvrage est édité dans le style de l'ouvrage principal et reprend les 41 planches originales.

CBS LIST OF CULTURES. 1983. 30th edition, anonymous, xii + 423 p., 8°, broché, 1983. Centraalbureau voor Schimmelcultures, P.O. Box 273, 3740 AG, BAARN, The Netherlands. Price: Hfl. 35.- (microfiche edition: Hfl. 10.-).

These 30th edition of the catalogue of the CBS Culture Collection has been extended with approximately 3.000 cultures and now lists a total of 28.000 strains. That includes 21.500 filamentous fungi, 5.000 yeasts and 1.500 actinomycetes. About 3.500 of these are type strains. Data on source, isolation date, depositor's name, mating type and known biochemical properties are given for each strain. The nomenclature of the fungi has been revised in accordance with the Sydney International Code of Botanical Nomenclature.

AUSTRALIAN NATIONAL REFERENCE LABORATORY IN MEDICAL MYCOLOGY. LIST OF CULTURES, JANUARY 1984. 42 p., Din. 1984. Royal North Shore Hospital, St Leonards, N.S.W. 2065, Australia.

This is the catalogue of the AMMRL Fungus Culture Collection founded by Dr. Shirley Campbell at Sydney in 1949. It mainly comprises filamentous fungi, including a large number of dermatophytes, yeasts and actinomycetes. Short data on source, locality and depositor are given for each strain.

MUSHROOM, THE JOURNAL OF WILD MUSHROOMING, par Don H. COOMBS et Maggie ROGERS, éditeurs, publié 4 fois par an, 50 p. par fascicule, 4°, vol. 1, n°1, Automne 1983. Publ. Mushroom Ltd. Box 3156, University Station, Moscow, ID 83 843, USA. Prix de souscription: personnelle US \$ 12.- 1'an, institution US \$ 16.- 1'an. Réduction pour souscription pluriannuelle.

Au premier regard, ce périodique témoigne de l'enthousiasme actif et sérieux de ses éditeurs fondateurs. Il s'adresse à tous mycologues amateurs ou professionnels intéressés de loin ou de près à la récolte et à la culture des champignons jusqu'à la dégustation. Edités par des mycologues passionnés, ces textes ont bonne allure et restent très accessibles. Vous y trouverez des descriptions précises et illustrées d'espèces, des commentaires sur l'identification des espèces, des biographies de mycologues réputés, des informations détaillées sur les publications et les réunions, des conseils de tous genres, même culinaires et encore, fort heureusement, de l'humour. Il faut croire que ce périodique aura aussi son succès en Europe comme il semble l'avoir déjà aux U.S.A.

AGARIC FLORA OF THE LESSER ANTILLES, par David N. PEGLER, Kew Bulletin Additional Series, vol. 9, iv + 670 p., 129 fig. 27 planches coul. h.t., 8°, broché, 1983. Her Majesty's Stationery Office, 49 High Holborn, London WC IV 6HB.

Depuis que Patouillard eut décrit dans sa "Famille des Agaricacées" 127 espèces des îles Guadeloupe et Martinique, rien ne fut décrit à nouveau. Encouragé par les excellentes récoltes de Jean-Pierre Fiard, un mycologue de la Martinique, l'auteur a, avec ce dernier, pu réunir sur la décade passée les matériaux de la flore des Petites Antilles, Martinique, Guadeloupe, Dominique, Marie Galante, Montserrat, Antigue, Ste Lucie, St Vincent, Grenade et les Barbades. Pour l'identification, l'auteur dut avoir recours à l'étude de nombreux types de la flore d'Amérique centrale, septentrionale et méridionale, dans les collections de Patouillard, de Murrill, de Berkeley et Curtis, de Massee et encore de Dennis. Cette flore, ici couverte, est très riche, préservée grâce aux forêts d'altitude encore vierges. 457 espèces appartenant à 106 genres d'agaricales sont ici décrites avec le plus grand soin. Pas de genre nouveau, mais *Inophilus* (Romagn.) Pegler est proposé. 70 espèces nouvelles et 39 nouvelles combinaisons sont proposées. Parmi elles citons 8 espèces d'*Agaricus*, 3 d'*Amanita*, 9 d'*Inocybe*, 6 de *Lepiota* et 6 d'*Hygrocye*. Le système de classification suivi est celui de Singer, à part les touches personnelles de l'auteur dans les familles des Entolomatacées et Polyporacées. Il faut apprécier la précision qu'ont mis l'auteur et

son collaborateur, J.P. Fiard, à la rédaction et l'illustration de ces descriptions. Les détails microscopiques de chaque taxon sont soigneusement qualifiés et mesurés. Les dessins sont fins et très parlants. Les 212 photos couleurs de carpophores sont très bonnes mais elles eurent, à mon avis, gagné de ne pas être imprimées encadrées de noir. On s'imagine aisément l'intense travail que demande une telle flore et c'est heureux que des mycologues puissent avoir le temps de l'entreprendre.

THE GENUS LENTINUS, A WORLD MONOGRAPH, par David N. PLEGER, Kew Bulletin Additional Series, vol. 10, iv + 282 p., 65 fig., broché, 1983. Her Majesty's Stationery Office, 49 High Holborn, London WC1V 6HB. Prix: £ 15.-

Qui s'intéresse au Shiitake, le champignon japonais, s'intéresse à cette monographie du genre *Lentinus* mais pour ne pas y trouver l'espèce classiquement dénommée *Lentinus edodes* car en 1975, l'auteur l'avait retirée de ce genre pour la classer comme *Lentinula edodes* (Berk.) Pegler en raison de son système hyphal monomitique.

Cette monographie n'en garde pas moins toute sa valeur. Des 514 taxa classés dans *Lentinus* Fries, l'auteur garde 63 espèces réparties en 15 sections. Moins fréquents dans nos régions tempérées, les *Lentinus* représentent un élément dominant de la flore fongique des forêts tropicales. Souvent récoltés mais aussi souvent difficiles à déterminer du fait de leur grande variabilité et de leur anatomie complexe. "Indeed, some *Lentinus* species are said to have the most complicated structure of all fungi" nous dit l'auteur. Cela n'a pas empêché l'auteur de proposer une monographie complète. Proche d'*Agaricus*, le genre *Lentinus* fut créé par Fries avec 20 espèces dès l'origine et, pour un certain nombre, tropicales. Sieurin, Lloyd, Petch, Pilat contribuèrent à la connaissance de ce genre. Singer y appliqua son système de classification basé sur les systèmes d'hyphes et déclassa le genre des Agaricales pour le classer dans les Polyporacées parce que monomitique. Cependant, Pegler avec Kühner devait montrer la situation de transition du genre par l'existence de systèmes dimitique et trimitique et classa le genre dans les Pleurotacées. A l'inverse de Corner qui retient le genre *Panus* pour ses hyphes squeletiques, en opposition à *Lentinus* qui possède des hyphes ligatives, Pegler réduit le genre *Panus* à l'état de section de *Lentinus*, comprenant 9 espèces. Chaque espèce est illustrée d'un fin dessin de pleine page représentant le carpophore, le système hyphal, les basides, les cystides et les spores. Toutes les descriptions sont augmentées de commentaires sur l'étude des types, les critères taxonomiques, l'analyse critique de la littérature et l'écologie de l'espèce. Il va sans dire que cette monographie sera appréciée pour sa qualité.

FUNGI OF THE INDIAN SUBCONTINENT. A COLLECTION OF PAPERS, par J. CRAMER éd., Bibliotheca Mycologica vol. 91, vi + 684 p., ill., 8° (14x22cm), relié toilé, 1983. J. Cramer, AR Gautner Verlag, FL-9490 Vaduz, Lichtenstein. Prix: DM 200.- (subscr. 160.-).

Cet assemblage de 48 contributions de mycologues indiens, dû apparemment à l'initiative de J. Cramer, porte sur la mycoflore de l'Inde et des pays limitrophes et couvre tous les groupes de champignons. Une contribution porte sur les Mixomycètes, une autre sur *Dictyuchus* et une

et une autre sur des Saproblégnales, deux sur *Absidia* et *Mucor* (Zygomycètes). Dix-huit traitent d'Ascomycètes. A côté de *Chaetomium*, *Podospora*, *Lophodermium*, 15 contributions ont trait aux Discomycètes, écrites par M.P. Sharma, R. Sharma, K.S. Thind, S.C. Kaushal. *Daedalea*, *Calvatiella*, *Polyporus*, *Inocybe*, *Russula* sont parmi les Basidiomycètes décrits. Quelques articles portent aussi sur des Hyphomycètes, en particulier les espèces thermophiles. Une douzaine de contributions s'intéressent plus particulièrement à l'écologie des champignons dans le milieu aquatique de marais, dans les sols alcalins, dans les mangroves, et à la symbiose mycorhizienne. Vingt-six nouvelles espèces sont proposées dans les genres suivants: *Russula* (3), *Lactarius* (1), *Calvatiella* (1), *Scutellinia* (2), *Lambertella* (1), *Dasyscyphus* (1), *Sclerotinia* (1), *Mollerodiscus* (2), *Poculum* (1), *Cordierites* (1), *Lanzia* (2), *Leptoxypinum* (1), *Candida* (1), *Phaeroramularia* (2), *Mucor* (1), *Blastocladia* (1) et *Dictyuchus* (1). Onze combinaisons nouvelles sont proposées.

THE GASTEROMYCETES OF CHINA, par BO LIU, Beihefte zur Nova Hedwigia, vol. 76, 240 p., 62 fig. b.n. et coul., 8°, relié toilé, 1984. J. Cramer, AR Gantner Verlag, FL-9490 Vaduz, Lichtenstein. Prix: DM 120.- (souscription: DM 96.-).

Depuis 20 ans, l'Auteur récolte et étudie les gastéromycètes de tous les coins de la Chine. Ce groupe de champignons est particulièrement recherché en Chine pour ses espèces comestibles ou à propriétés médicinales, technologiques, mycorhiziennes et biodégradantes. Cent quarante-trois espèces appartenant à 40 genres sont décrites et un certain nombre illustrées par des photographies blanc-noir et couleurs. L'auteur couvre successivement les Phallales, les Lycoperdales, les Hymenogastrales, les Nidulariales, les Sclerodermatales et les Tulostomatales. Nombreuses sont les espèces exclusivement asiatiques décrites par l'auteur et d'autres mycologues chinois durant les dix dernières années. Les descriptions sont soignées et accompagnées d'une synonymie, de la mention d'habitat et de celle de la distribution géographique limitée au niveau de la province chinoise. Parmi l'illustration, neuf aquarelles représentent 4 espèces de Clathraceae et 5 espèces de Phallaceae. Ce livre est un heureux témoignage de l'activité mycologique en plein essor de nos collègues chinois. Il sera certainement apprécié.

BIOLOGICAL RECLAMATION AND LAND UTILIZATION OF URBAN WASTES, par F. ZUCCONI, M. DE BERTOLDI et S. COPPOLA, 764 p. ill., 8°, broché, 1983. F. Zucconi, Istituto di Coltivazioni Arboree, Università degli Studi di Napoli, 80055 Portici, Napoli, Italia.

These Proceedings of the International Symposium on Biological Reclamation and Land Utilization of Urban Wastes, Napoli, 11-14 October 1983, may appear to fall out of the scope of Systematic Mycology but worth a mention. Composting is the domestication of the natural turnover of brute organic matters, in which fungi, particularly thermophilic fungi, play a large role. Through 47 papers, the full process and all aspects of composting will be discovered.

CBS COURSE OF MYCOLOGY, 2d Edition, 1980, par W. GAMS et al., 110 p., ill., 8° (17x24cm), broché, 1980. Centraalbureau voor

Schimmelcultures, Baarn, Nederland.

Le cours de Mycologie pratiqué au CBS est une introduction théorique et pratique à la mycologie systématique et à l'identification des champignons. Ce syllabus est essentiellement le support de séances de démonstration où l'usage des cultures pures de champignons préservées en collection est un matériel d'étude essentiel à l'identification des Zygomycètes, Ascomycètes et Deuteromycètes. Le matériel naturel, cependant, est utilisé dans l'identification des Basidiomycètes, des Myxomycètes et de quelques Ascomycètes et champignons aquatiques. L'insistance est donnée sur les techniques de cultures, de description, de dessin et l'usage de la littérature. Le texte est d'ailleurs présenté avec d'abondants dessins et schémas et suivi d'une longue sélection de littérature mycologique.

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